QC
983
.A27

VOLUME 68 [W. B. No. 1267] NUMBER 5

SEP 9 1940

MONTHLY WEATHER REVIEW

MAY 1940

CONTENTS

	Page
Sounding-Balloon Observations at Omaha, Nebr., During the International Months July 1935 and April 1936. (4 figs.) L. P. Harris	135
The First Century of Meteorological Data at Abingdon. (1 fig.) Ralph E. Brown	139
Solar Observations	144
Aerological Observations	147
Rivers and Floods	143
Weather on the Atlantic and Pacific Oceans. (1 fig.)	147
Climatological Tables	150
Charts I–XIII (Chart VII Used Only During Snow Season)	

UNITED STATES DEPARTMENT OF AGRICULTURE
WEATHER BUREAU
WASHINGTON, D. C.
1940

For sale by the Superintendent of Documents, Washington, D. C. - See page 4 of cover for prices

MONTHLY WEATHER REVIEW

Editor, EDGAR W. WOOLARD

VOL. 68, NO. 5
W. B. NO. 1297

MAY 1940

CLOSED JULY 3, 1940
ISSUED AUGUST 16, 1940

SOUNDING-BALLOON OBSERVATIONS AT OMAHA, NEBR., DURING THE INTERNATIONAL MONTHS JULY 1938 AND APRIL 1939

By L. F. HAFER

[Weather Bureau, Washington, D. C., February 1940]

The Weather Bureau made daily sounding balloon observations at Omaha, Nebr., during the International Months of July 1938 and April 1939. These observations were similar to observations made during the International Months of previous years.

Forty-nine Fergusson meteorographs, each attached to a balloon carrying a Jaumotte meteorograph, were released during the July 1938 series, 12 of these observations being made to study the effect of insolation on the 2 types of instruments. Thirty-six Fergusson meteorographs were released during April 1939. In each of these months 1 observation was made each day about 1 hour before sunset in accordance with past practice during International Months. On the 6 International Days in each of these months, an additional observation was made just after sunrise.

The arrangement of equipment was as follows: Balloon, parachute, cord, combination of cord and rubber shock cord, and meteorographs.

The balloons used were of the 700-gram type. They were inflated to 1,100 grams free lift in order to secure an ascensional rate of about 360 or 380 meters per minute. For the first 29 days of the July series, the balloons were inflated with hydrogen, while on the last 2 days of July and for the entire April series they were inflated with helium. When the balloons were inflated with helium, they were somewhat larger, after inflation, than on days on which hydrogen was used.

Weather conditions permitting, the balloons were followed with two theodolites so that winds aloft could be determined, and also to serve as a check on the maximum heights as computed from the meteorograph records.

The parachutes used were made of red silk and were about 1 yard square in size.

Tables 1 and 2 show the tropopause and maximum elevation data for both series.

It will be noted that the maximum height to which a balloon was followed with two theodolites during the July series was 29,540 meters; and in April, 27,360 meters. The average computed maximum altitude for July was about 26 kilometers, which was about 4 kilometers higher than the April average. The greater heights reached by the instruments in July were due to the fact that hydrogen was used instead of helium. There may also have been a seasonal effect. In the April series the balloons generally burst about 12 minutes earlier than in July.

Figure 1 shows the mean temperature for each of the two series, plotted against height. July was warmer than April to about 13 kilometers and then colder to about 19 kilometers; above 19 kilometers the two curves are almost identical. The April temperature curve showed a tendency to become isothermal at about 25 kilometers, while in July the inversion in the stratosphere continued to the maximum elevation. This agrees with results obtained in previous years, which showed a seasonal variation in

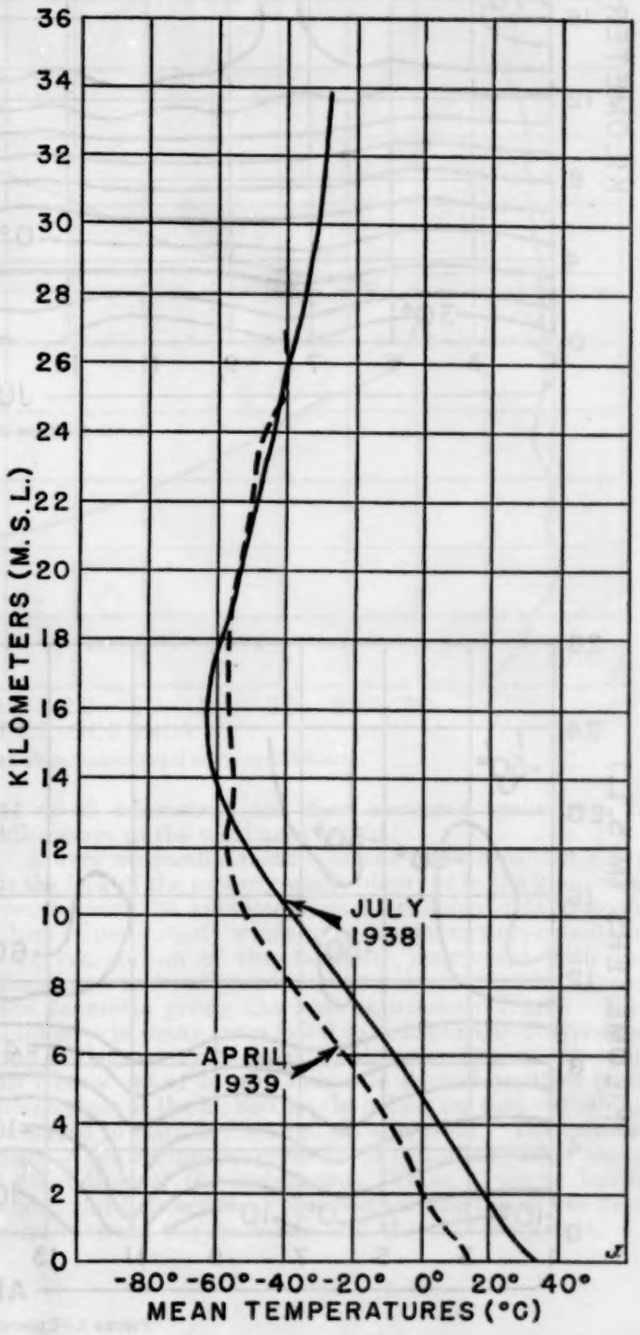


FIGURE 1.—Mean temperature for each of the two series, plotted against the height.

244521—40——1

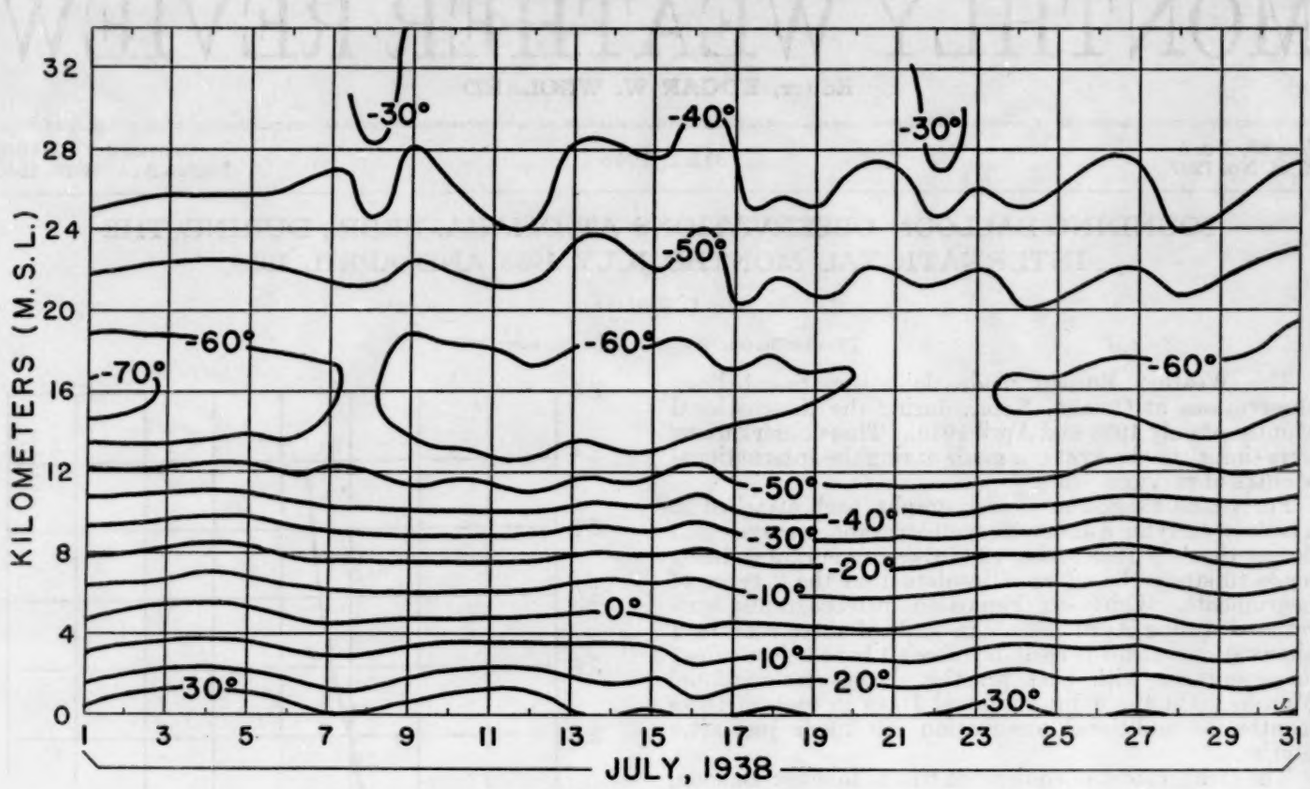


FIGURE 2.—Upper-air isotherms for July 1938.

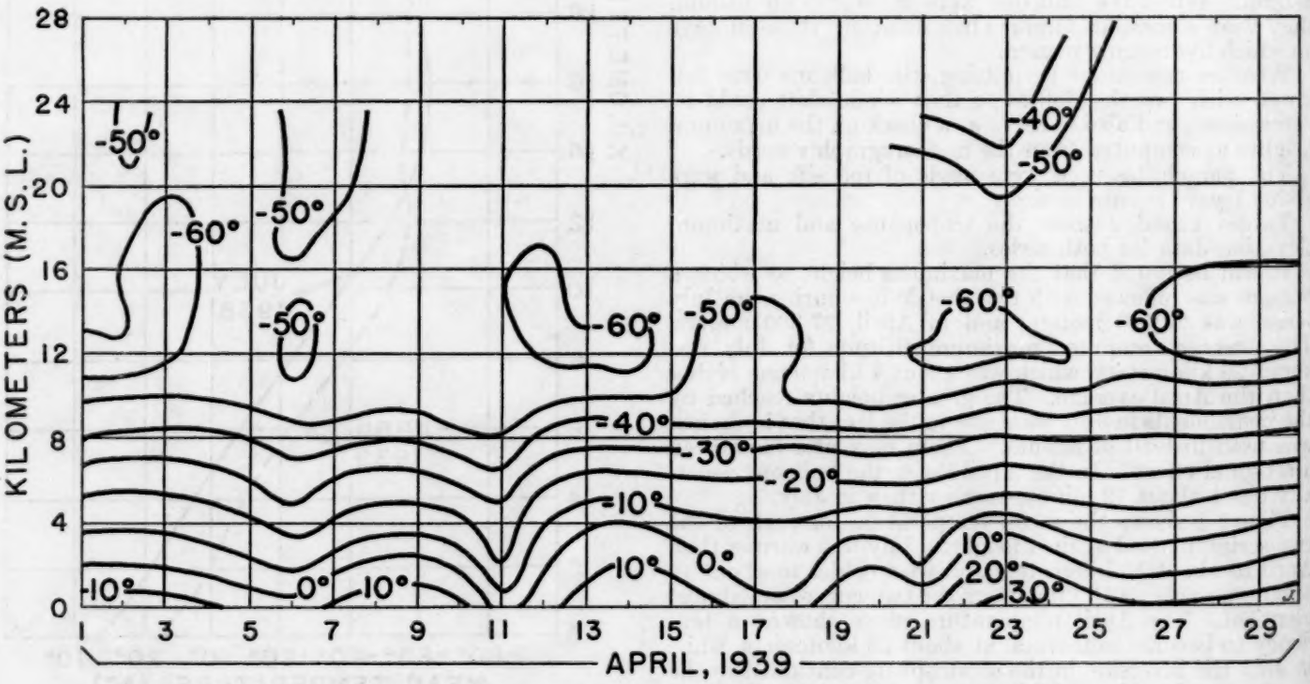


FIGURE 3.—Upper-air isotherms for April 1939.

DEPOSITED BY THE
UNITED STATES OF AMERICA
SEP 18 '40

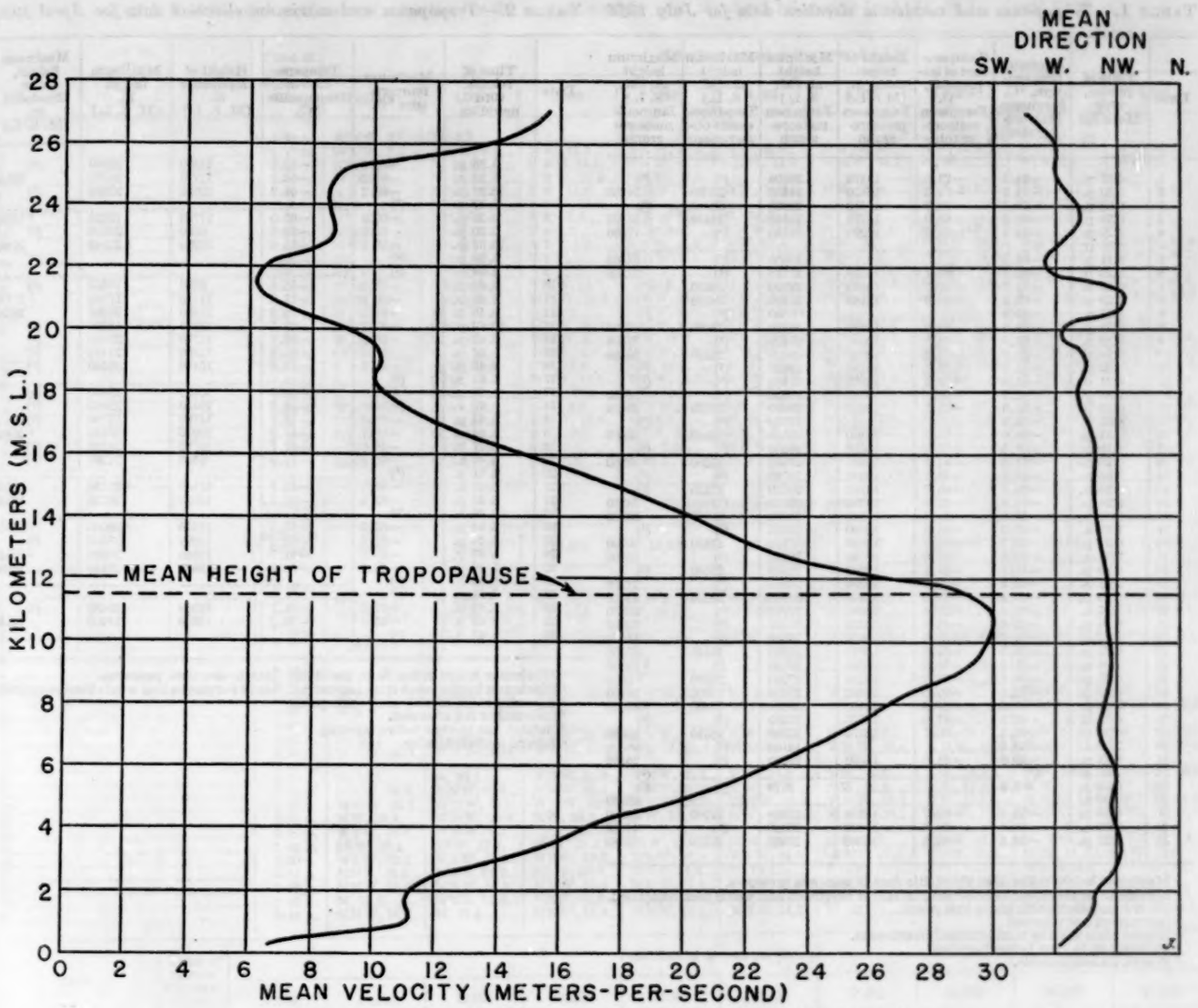

MEAN
DIRECTION
SW. W. NW. N.
KILOMETERS (M.S.L.)
MEAN HEIGHT OF TROPOPAUSE
MEAN VELOCITY (METERS-PER-SECOND)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

FIGURE 4.—Average wind velocity and direction plotted against height for the April 1939 series.

the amount of the temperature inversion in the stratosphere; the summer months show large inversions and the winter months little or no inversion.

Figures 2 and 3 show upper air isotherms for July 1938 and April 1939, respectively.

Table 3 shows the wind directions and velocities observed at the surface and at each standard kilometer level for the April series.[1]

Figure 4 shows the average wind velocity and direction plotted against height for the April series. The maximum wind velocity occurred about 1 kilometer below the mean height of the tropopause. This occurrence of the maximum mean velocity at an altitude just below the mean height of the tropopause is in agreement with the results of previous years. The velocity showed a decrease from 11 to 22 kilometers, and then increased again from 22 kilometers to the maximum height.

A very noticeable feature of the wind direction curve is the lack of the easterly winds observed in the 2 previous years above 20 kilometers; and available data indicate these upper easterly winds to be a summertime condition.

A comparison of the Jaumotte instrument with the Fergusson and radiosonde in the July 1938 series showed the Jaumotte giving the least satisfactory results. The Jaumotte in many cases failed to indicate small inversions and isothermal layers shown by the other two instruments. In 7 cases out of 46, the Jaumotte showed negative pressure values at the highest levels, indicating that something occurred to disturb the original calibration. The calibrations of the Jaumotte appear to be disturbed rather easily by handling of the instrument. Table 1 shows better agreement between the Fergusson and the theodolite data than between the Jaumotte and the theodolite data.

[1] Wind data for the July 1938 series has been published in the Monthly Weather Review, November 1938.

TABLE 1.—*Tropopause and maximum elevation data for July 1938*

Date	Time of release, 90th Meridian	Minimum temperature, °C. Fergusson Meteorograph	Temperature of tropopause, °C. Fergusson meteorograph	Height of tropopause m. (M.S.L.) Fergusson meteorograph	Maximum height m. (M. S. L.) Fergusson meteorograph	Maximum height m. (M. S. L.) Two-theodolite observations	Maximum height m. (M. S. L.) Jaumotte meteorograph
1	6:07 p.	−74.6	−74.6	15570	28690	(6)	(7)
2	6:39 p.	−74.3	−74.3	16130	24450	25000	24250
3	6:38 p.	−70.7	−70.7	16410	21860	22180	(4)
4	6:34 p.	−68.0	−68.0	15770	24340	24330	36100
4	8:29 p.	−64.4	−64.2	14290	24150	(6)	17600
5	6:30 p.	(4)					
5	8:11 p.	−62.2			[3] 13600	(6)	34360
6	6:25 p.	−66.1	−66.1	15530	27480	(6)	21200
7	6:29 p.	−61.7	−60.1	15160	28820	28090	(7)
8	6:29 p.	−60.3	−59.9	15180	30460	29360	(7)
8	8:15 p.	−52.4			[3] 5800	(6)	(7)
9	6:26 p.	−64.6	−63.2	14300	34360	29490	[3] 5800
9	8:12 p.	−67.5	−66.7	14850	27520	(6)	22800
10	6:24 p.	−62.7	−62.6	13940	28320	28520	28320
10	8:02 p.	−64.3	−63.5	14100	28420	(6)	(7)
11	6:21 p.	−65.5	−65.5	14910	27490	(6)	(7)
11	7:58 p.	−64.7	−64.7	16530	24870	(6)	18000
12	6:26 p.	−63.3	−62.7	13810	25960	27030	20400
12	8:07 p.	−59.9			13760	(6)	(7)
13	6:24 p.	−65.0	−65.0	16100	[3] 29540	29540	26400
13	8:16 p.	−67.0	−66.2	15500	24200	(6)	(6)
14	6:26 p.	−64.3	−64.3	15340	27340	25680	[3] 10250
14	7:55 p.	−64.6	−64.1	16940	24780	(6)	(7)
15	6:23 p.	−66.7	−66.7	14160	26780	27120	(7)
16	6:24 p.	−64.8	−63.4	14290	29470	(6)	28150
17	6:47 p.	−61.9	−61.5	15110	20600	21650	23980
18	1:57 a.	−65.0	−64.3	16590	26310	(6)	(6)
18	6:29 p.	−62.7	−62.7	15500	27170	27830	20700
19	2:06 a.	−62.8	−62.8	16530	19210	(6)	16700
19	6:20 p.	−61.1	−61.1	13040	21900	25060	(4)
20	2:05 a.	−63.8	−63.8	13590	24960	(6)	21700
20	6:19 p.	−60.3	−59.4	13210	29020	28250	[3] 12550
21	2:15 a.	−61.4	−59.6	13990	22200	(6)	22350
21	6:26 p.	−62.6	−62.6	13250	31320	(6)	22000
22	1:59 a.	−59.7	−59.0	12600	23560	(6)	11400
22	6:21 p.	−59.3	−59.3	13010	28090	29440	23450
23	2:04 a.	−59.8	−59.8	13560	26340	(6)	[3] 12300
23	6:21 p.	−59.1	−58.3	12790	27230	26800	[3] 7000
24	6:22 p.	−62.5	−62.5	15860	27000	[2] 27000	16400
25	6:20 p.	−61.6	−61.6	15530	20650	20400	[3] 13650
26	6:16 p.	−63.3	−61.0	15070	29260	(6)	(6)
27	6:30 p.	−66.3	−66.1	15370	27280	26310	25550
28	2:33 a.	−60.2			14100	(6)	16800
28	6:23 p.	−65.0	−64.8	15010	27060	(6)	26150
29	2:30 a.	(7)					(6)
29	6:35 p.	−2.6			5070	(6)	(7)
30	2:00 a.						16750
30	6:30 p.	−63.0	−62.7	15810	27490	27900	25900
31	2:32 a.	−67.4	−66.3	17000	26490	(6)	17650
31	6:27 p.	−64.5	−64.5	16200	27850	27700	22380

[1] Maximum height taken from theodolite data to compute pressures.
[2] Maximum height taken from ascensional rate of Fergusson and winds then computed.
[3] Record undecipherable above this point.
[4] Instrument not returned.
[5] Record plate missing from returned instrument.
[6] Balloon lost to view before bursting.
[7] Record undecipherable.

TABLE 2.—*Tropopause and maximum elevation data for April 1939*

Date	Time of release 90th meridian	Minimum temperature °C.	Temperature of tropopause °C.	Height of tropopause m. (M. S. L.)	Maximum height m. (M. S. L.)	Maximum height, from theodolite m. (M. S. L.)
1	5.36 p.	−63.0	−62.1	11290	22640	(5)
2	5.27 p.	−65.2	−65.2	11770	21330	23640
3	5.27 p.	−63.2	−63.2	13000	22600	(5)
4	5.27 p.	(5)				
5	5.55 p.	−60.0	−60.0	11760	19320	[3] 19320
6	5.30 p.	−52.0	−52.0	8950	20310	(5)
7	5.53 p.	−55.5	−55.5	10280	[1] 21940	21940
8	5.50 p.	(4)				
9	5.44 p.	(5)				
10	6.00 p.	−58.1	−56.4	8620	18550	(5)
11	5.46 p.	−60.6	−57.3	11170	17190	17470
12	5.46 p.	−61.7	−59.2	11400	20580	20030
13	5.40 p.	−63.7	−63.7	12160	18320	(5)
14	5.42 p.	−64.2	−64.2	11710	20060	(5)
15	5.57 p.	−61.0	−61.0	12300	21430	(5)
16	5.42 p.	−56.8	−55.8	16440	20540	(5)
17	5.41 a.	(4)				
17	5.45 p.	−56.4	−52.3	10490	18850	(5)
18	5.42 a.	−56.0	−54.5	10480	22660	(5)
18	5.43 p.	−58.4	−55.7	10780	17780	(5)
19	5.44 a.	−60.7	−55.3	10910	20440	[3] 20440
19	5.47 p.	−58.6	−57.7	10790	21350	(5)
20	5.40 a.	−56.8	−54.6	9460	21260	(5)
20	5.51 p.	(5)				
21	5.47 a.	−55.9	−55.7	11150	[3] 21550	27360
21	5.44 p.	−62.6	−62.6	12020	18730	18380
22	5.48 a.	(5)				
22	5.54 p.	−68.5	−68.5	12340	20060	19810
23	5.46 p.	−67.2	−67.2	12620	23600	(5)
24	5.43 p.	−61.7	−61.7	11940	20630	[3] 20630
25	5.50 p.	−59.2	−59.2	12830	27840	26080
26	5.45 p.	(5)				
27	5.51 p.	(4)				
28	5.45 p.	−61.3	−61.1	12090	19480	(5)
29	5.43 p.	−66.0	−66.0	12500	18400	19140
30	5.44 p.	(4)				

[1] Maximum height taken from theodolite data to compute pressures.
[2] Maximum height taken from ascensional rate of Fergusson and winds then computed.
[3] Record undecipherable above this point.
[4] Instrument not returned.
[5] Balloon lost to view before bursting.
[6] Record undecipherable.

TABLE 3.—*Wind directions and velocities for the surface and for each standard kilometric level, M. S. L., April 1939*

Date	Time of release 90th meridian	Velocities in meters per second								
		Surface	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000
1	5:36 p.	WNW, 2.7	W, 5.7							
2	5:27 p.	WNW, 7.2	NNW, 9.5	NW, 11.7	NNW, 18.7	NW, 21.5	NW, 38.4	NW, 31.8	WNW, 33.6	NW, 30.6
5	5:55 p.	NW, 13.4	N, 15.3	NNW 16.6	NNW, 24.1	WNW, 22.6	WNW, 37.7	W, 43.1	W, 42.1	W, 44.2
6	5:30 p.	W, 8.9	N, 18.4	NNW, 17.2	NNW, 17.2					
7	5:53 p.	NW, 9.8	NNW, 12.4	NW, 14.9	WNW, 17.2	NW, 27.0	NW, 22.0	NW, 31.6	NW, 32.2	NW, 31.5
8	5:50 p.	N, 3.1	NW, 2.8	WSW, 12.1						
9	5:44 p.	NNW, 7.2	NNW 8.6	NW, 8.4	WNW 11.0	W, 18.8	W, 31.9			
10	6:00 p.	NW, 6.7	NNE, 9.3	N, 12.2	N, 16.0	NNW, 14.9	NNW,14.4	NW, 14.0		
11	5:46 p.	NW, 11.2	NNW, 12.7	NW, 15.9	NNW, 21.2	NW, 23.4	NW, 30.7	WNW, 38.3	WNW, 42.9	WNW, 47.4
12	5:46 p.	SE, 5.4	S, 6.3	W, 2.2	WNW, 9.1	WNW, 16.3	WNW, 21.5	WNW, 24.0	WNW, 27.1	WNW, 29.2
13	5:40 p.	SE, 8.5	SW, 18.4							
19	5:44 a.	W, 0.4	NW, 5.6	NNW, 12.1	N, 20.8	N, 17.9	NNW, 19.6	NNW, 23.0	NNW, 30.1	NNW, 30.7
19	5:47 p.	SSW, 5.4	SW, 6.8	WNW, 12.5	NNW, 13.8	NW, 14.3	NW, 17.0	NW, 17.7	NW, 18.1	WNW, 20.0
20	5:40 a.	W, 3.1	N, 13.0	N, 13.2	NNW, 11.0	NNW, 17.5				
21	5:47 a.	NNW, 4.9	NNW, 13.1	NNW, 15.2	NNW, 17.4	NNW, 21.5	NNW, 23.8	N, 31.8	N, 37.0	N, 38.8
21	5:44 p.	W, 3.1	W, 6.6	WNW, 8.2	NW, 16.7	NW, 19.2	NNW, 24.7	NNW, 29.6	NNW, 33.2	NNW, 32.4
22	5:48 a.	SSE, 4.9	SSW, 25.8	WSW, 5.5	WNW, 6.8	NW, 12.7	NW, 14.2	NW, 14.4	WNW, 17.1	WNW, 16.7
22	5:54 p.	S, 8.0	SSW, 19.9	SW, 14.0	SW, 19.6	W, 17.8	W, 13.4	WNW, 11.4	WNW, 14.4	WNW, 17.8
23	5:46 p.	S, 9.8	SSW, 19.4	WSW, 15.1	WSW, 15.8	WSW, 17.8	WSW, 17.6	W, 12.4	WSW, 8.9	SW, 11.9
24	5:43 p.	S, 13.0	S, 16.4	SSW, 17.4	SW, 12.8	SSW, 13.2	SSW, 20.2	SSW, 23.4	SSW, 22.4	SSW, 23.6
25	5:50 p.	WNW, 5.4	NW, 6.2	NW, 3.5	WNW, 8.4	SW, 18.3	WSW, 15.1	WSW, 18.1	WSW, 20.0	WSW, 19.8
27	5:51 p.	NNW, 9.8	N, 14.3	NNW, 13.8	N, 16.2	N, 14.3	NNE, 22.0	NNE, 25.5	NNE, 34.7	NNE, 34.1
28	5:45 p.	NE, 6.7	N, 3.3	NE, 10.0	NNE, 8.2	NE, 8.0	NNE, 10.7	N, 9.7	N, 13.6	NNW, 12.7
29	5:43 p.	SSE, 4.0	SSW, 4.8	SW, 3.7	SW, 2.2	NNW, 1.2	N, 2.5	N, 5.6	N, 5.6	N, 8.6
30	5:44 p.	SSE, 4.0	S, 2.5	SW, 3.0	N, 6.2	N, 8.1	NNW, 9.3	N, 6.9	NNW, 10.6	NNW, 10.1

Date	Time of release 90th meridian	Velocities in meters per second								
		9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000	17,000
1	5:36 p.									
2	5:27 p.	NW, 43.2	WNW, 44.2	WNW, 48.7	WNW, 44.1	WNW, 40.8	WNW, 34.7	WNW, 32.5	NW, 29.3	WNW, 24.2
5	5:55 p.	WSW, 46.5	SW, 49.1	SW, 47.2	W, 38.1	WSW, 30.0	W, 40.0	W, 20.5	W, 20.5	WNW, 6.4
6	5:30 p.									
7	5:53 p.	NW, 34.0	NW, 35.9	NNW, 28.2	NW, 23.6	NW, 21.0	WNW, 20.0	WNW, 21.0	WNW, 20.9	WNW, 17.1
8	5:50 p.									
9	5:44 p.									
10	6:00 p.									
11	5:46 p.	WNW, 55.9	WNW, 51.3	WNW, 46.5	WNW, 29.6	W, 26.6	W, 30.5	W, 24.2	WNW, 23.5	W, 19.4
12	5:46 p.	WNW, 30.4	WNW, 34.2	W, 45.7	W, 42.5	WNW, 39.3	W, 29.5	W, 23.2	WNW, 25.2	WNW, 19.6
13	5:40 p.									
19	5:44 a.	N, 27.1	N, 26.4	NNW, 26.7	NNW, 25.4	NW, 20.6	NW, 24.8	NW, 22.4	NW, 14.3	WNW, 18.5
19	5:47 p.	WNW, 23.0	WNW, 21.4	WNW, 30.0	WNW, 24.2	WNW, 24.5	WNW, 25.4	WNW, 24.3	WNW, 16.3	WNW, 13.3
20	5:40 a.									
21	5:47 a.	N, 41.1	N, 39.1	NNW, 33.2	NNW, 27.2	NW, 20.4	NW, 16.0	NW, 15.9	NW, 10.6	WNW, 10.5
21	5:44 p.	NNW, 34.4	NNW, 40.6	NNW, 42.4	NNW, 31.8	NW, 17.4	NW, 21.0	NW, 17.3	WNW, 11.6	W, 11.6
22	5:48 a.	WNW, 20.3	WNW, 19.3	WNW, 22.2	WNW, 23.0	WNW, 24.5	WNW, 18.3	NW, 17.9	WNW, 11.6	WNW, 14.0
22	5:54 p.	NW, 20.8	WNW, 23.6	NW, 26.4	NW, 27.4	NW, 23.1	WNW, 20.1	WNW, 16.3	WNW, 19.5	WNW, 17.5
23	5:46 p.	WSW, 13.7	WNW, 6.3							
24	5:43 p.	SSW, 29.4	SSW, 32.2	SSW, 34.7	SSW, 27.7	SSW, 19.9	SW, 18.4	WSW, 11.1	W, 2.6	WNW, 1.6
25	5:50 p.	WSW, 23.2	WSW, 23.2	WSW, 19.5	WSW, 24.8	WSW, 19.8	WSW, 11.6	WSW, 11.1	SSW, 11.2	SW, 12.0
27	5:51 p.	NNE, 34.8	NNE, 34.2	NNE, 34.7	NNE, 34.8	N, 19.4	NNW, 12.2	NW, 13.5	WNW, 6.8	NNW, 3.9
28	5:45 p.	NNW, 15.6	NNW, 16.0	NNW, 15.4	NNW, 17.6	NNW, 11.8	NNE, 11.0	NNW, 12.5	N, 10.4	
29	5:43 p.	N, 10.8	NNE, 11.0	NNE, 12.6	NNE, 16.8	NE, 19.6	NNW, 8.8	NNW, 15.4	N, 8.3	NNW, 9.4
30	5:44 p.	NNW, 10.7	N, 13.5	NNW, 11.4	NNW, 12.1	NNW, 14.3	N, 16.1	N, 16.4	NNW, 17.0	NNW, 13.1

Date	Time of release 90th meridian	Velocities in meters per second									
		18,000	19,000	20,000	21,000	22,000	23,000	24,000	25,000	26,000	27,000
1	5:36 p.										
2	5:27 p.	WNW, 16.9	NW, 14.8	WNW, 10.2	W, 11.4	WNW, 12.5	W, 6.4				
5	5:55 p.	WNW, 5.1	W, 14.5								
6	5:30 p.										
7	5:53 p.	WNW, 20.6	WNW, 16.0	WSW, 12.0	W, 11.9	W, 12.8					
8	5:50 p.										
9	5:44 p.										
10	6:00 p.										
11	5:46 p.										
12	5:46 p.	W, 16.2	WNW, 7.8	W, 8.9							
13	5:40 p.										
19	5:44 a.	WNW, 14.4	WNW, 10.8	W, 7.2							
19	5:47 p.	WNW, 18.4									
20	5:40 a.										
21	5:47 a.	W, 5.2	W, 10.5	WSW, 11.6	W, 7.8	SSW, 8.3	WSW, 15.4	WSW, 14.5	SW, 11.0	SW, 19.1	WSW, 20.8
21	5:44 p.	W, 8.8									
22	5:48 a.	WNW, 9.7	WSW, 16.6	W, 14.9	NW, 10.8						
22	5:54 p.	NW, 14.8	NW, 13.9								
23	5:46 p.										
24	5:43 p.	S, 1.1	WNW, 2.2	NW, 7.2	N, 5.6						
25	5:50 p.	SW, 10.7	SW, 11.0	SW, 7.6	NE, 2.8	SSW, 1.7	W, 5.9	WNW, 10.2	NW, 9.0	NW, 10.8	
27	5:51 p.	WSW, 6.4									
28	5:45 p.										
29	5:43 p.	NNW, 8.4	NNW, 6.2								
30	5:44 p.	NNE, 11.4	N, 9.0	N, 9.3	NNE, 6.0	N, 3.0	NNW, 6.8	NW, 3.0	W, 8.4		

THE FIRST CENTURY OF METEOROLOGICAL DATA IN AMERICA

By RALPH H. BROWN

[University of Minnesota, September 1939]

Adequate information regarding the provenience of early meteorological data compiled in this country, is not easily available to present-day climatologists. Contemporary references to the early tabulations, and citations to bibliographic sources are, at best, fragmentary. Students of climatic cycles and long-time trends have been concerned mainly and necessarily with a few exceptional series extending through many consecutive years prior to the compilation of official observations.[1] In studies of the history of climatology interest has been mainly centered upon the relative times of beginning of records at certain stations together with the lengths of the periods during which individuals continued their observations.[2]

Obscured by this emphasis upon a few remarkable or especially useful records are numerous other tabulations, usually sporadic and shortlived, contemporary with them. Since the third century of activity in systematically recording weather data in this country is now opening, a memorialistic inventory seems appropriate.

This inventory includes only temperature and rainfall records, obtained instrumentally and with evident care, for at least 1 year, during the century from 1738 to 1838. In the interests of economy of space and simplicity, the principal information is presented graphically, to show the observation stations and the length of the record made at each; the inclusion of a station on this graph indicates that the data are available in the literature, though sometimes only in manuscript, and that they are believed to be accurate insofar as limited records can be. In the majority of cases observations of other weather phenomena were also made at the same places. Many known temperature and rainfall series, nearly 50 in number, have been deliberately omitted because they are of doubtful accuracy and validity or because the observations were frequently interrupted. Many other series perhaps entitled to inclusion in a select list of statistical resources contributed during the first centennium, may have been unknowingly excluded because the data have resisted discovery during a reasonably exhaustive search. Omissions of manuscript records are especially likely, since many may be on file in lesser known institutions or in the homes of descendants of the men who devoted themselves, without compensation, to this work.

One or more of the following four procedures have been followed in selecting the temperature and rainfall series for inclusion in this presentation:

(1) *Inspection of the manuscript record.*—The original manuscript record, if it can be found, is almost certain to contain internal evidence of its authenticity and of the integrity of the observer. Usually containing more detail than the published version (if, indeed, the data were ever published), the very appearance of the journal is a clue to the workmanship of the individual. A carefully made record may be presumed to imply equal care in the exposure and reading of the instruments even if precise information as to these circumstances is lacking. Usually, however, the original manuscript states exactly the names of the manufacturers of the instruments and gives details as to their exposure. For example, one learns from the first page of the 37-volume meteorological diary of Dr. E. A. Holyoke, that his long-time temperature series at Salem, Mass., was read from "accurate instruments made . . . in London and . . . suspended in the open air in the shade on the north side of my house in the main street of Salem about 7 feet above the ground," [3] valuable information omitted from the published data. In the Holyoke journal, as in the majority of early manuscripts still available, temperature data are given in tenths of a degree, strongly suggestive of precision in the reading of the instrument. Since there were no journals devoted to the printing of climatological material during this period, some of the data referred to in this inventory exist only in manuscript form, the most important collections being in the Essex Institute of Salem, the Harvard College Library, the American Academy of Arts and Sciences in Boston and the American Philosophical Society. The latter two institutions, during the half-century following the Revolution, took a special interest in the diffusion of climatological knowledge and devoted many pages of their *Transactions*, *Proceedings* and *Memoirs* to the reproduction of monthly and annual summaries compiled at many eastern points.

(2) *Comparison of the data with modern records.*—An estimate of the accuracy of early records may be formed by comparing them with the means derived from series of known reliability, due allowances being made, of course, for annual or short-period departures from averages. The greatest discrepancies between early and modern records usually occur in the rainfall data, perhaps owing mainly to the difficulty of measuring snowfall. For example, James Barrell, who kept a 10-year rainfall record at Charlestown, Mass. (1792–1802), states that his gage was "60 feet above the level of high water," but complains "I have no way [accurately?] to measure the snow." Nevertheless, Barrell seems to have done remarkably well, for his 10-year average of 39.9 inches agrees with modern computations.[4] It will be noticed from the graph that temperature was recorded more generally than rainfall, presumably because thermometers can be exposed and read with greater ease than rain gages. Discrepancies also arise from the different hours at which observations were made. The lowest temperatures often escaped record in the days prior to the common use of the maximum and minimum thermometer, thus causing daily means to be slightly higher than in modern records. Favored hours of observation were 8 a. m., 1 p. m., and sunset, or such as would not seriously interfere with the individual's principal occupation. The majority of the observers from 1738 to 1838 were, as might be surmised, physicians, clergymen, farmers, and professors.

(3) *The judgment of early climatological writers.*—A further check on the authenticity of some climatic data is provided by the evaluation given them by early writers, among whom was C. F. Volney, who, in the preparation of his geographical work published in 1803,[5] made a reasonably objective study of the climatic data then available and used those series that seemed to be most reliable. A much more valuable critique of the early data is to be found in

[1] For example: J. B. Kincer, "Is our Climate Changing? A study of long-time temperature trends," Mo. Wea. Rev., 61: 251–259, 1933.

[2] For example: B. B. Whittier, "An Old Weather Diary in Northeastern Indiana," Mo. Wea. Rev., 63: 224, 1935; J. R. Weeks, "Baltimore Weather Records for Over 100 Years," *Ibid.*, 61: 260, 1933; George S. Bliss, "Dr. Jesse C. Green, 1817–1920," *Ibid.*, 48: 413, 1921; J. Warren Smith, "Long Individual Meteorological Records," *Ibid.*, 48: 533, 1921.

[3] "A table of results, 1786–1791," Ms. Essex Institute.

[4] *Memoirs Amer. Acad. of Arts and Sciences*, 3: 104, 1809–19.

[5] *Tableau du Climat et du Sol des États Unis d'Amérique*, Courcier et Dentu, Paris.

Blodget's *Climatology*.[6] In the first chapter of this notable volume, Blodget offers a 50-page summary of "the statistics of meteorological observation" and lists nearly all the data that are of significance up to the year 1855. These tables, containing brief citations to the literature, provide a valuable reference book for the climatologist who is at all concerned with the earlier materials.

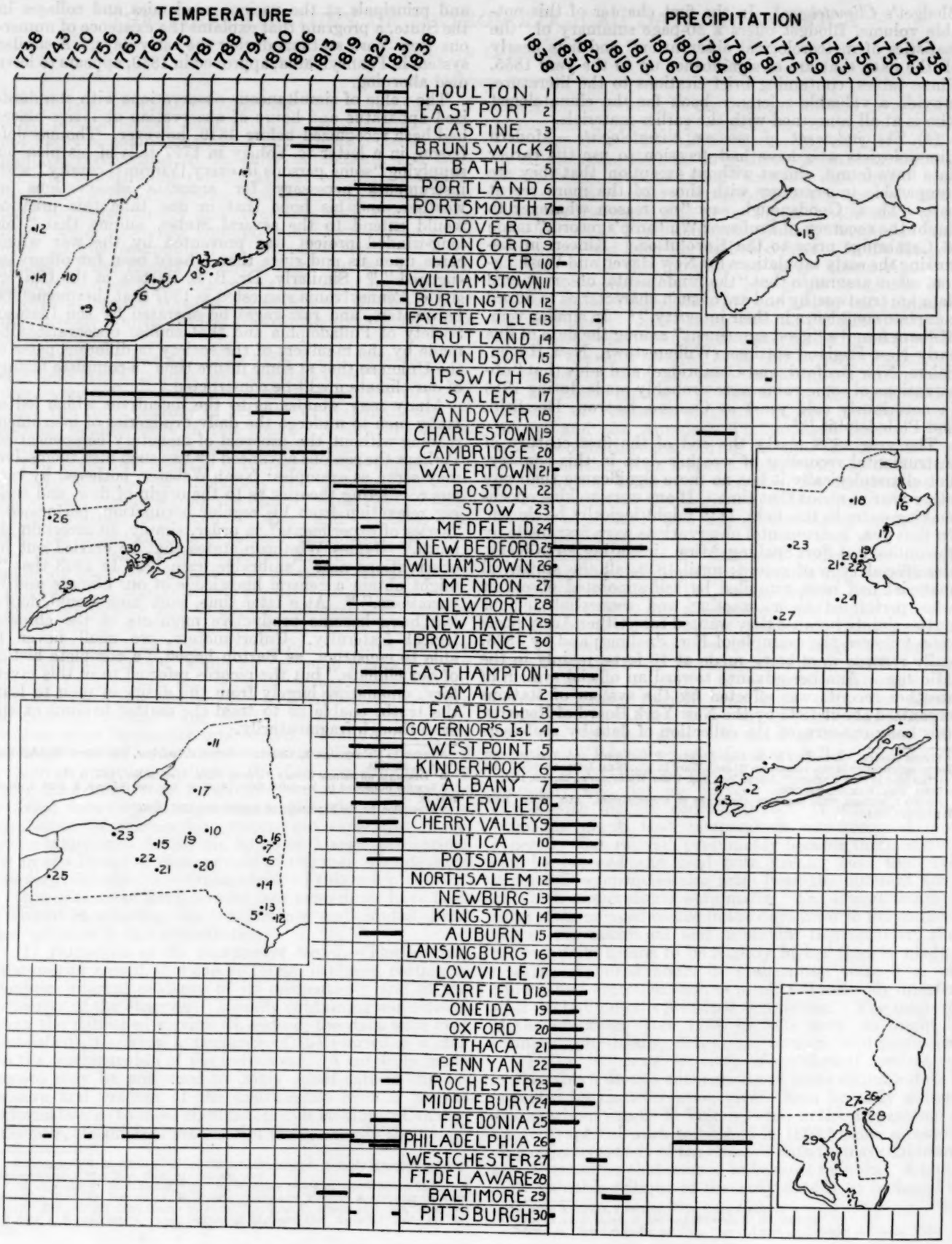
(4) *The judgment of modern climatologists.*—Modern climatologists who have had occasion to use the earlier data have found, almost without exception, that they are comparable in accuracy with those of the more recent past. Thus, Goodenough saw "no reason whatever to doubt the accuracy of Professor Winthrop's record," made at Cambridge prior to the Revolution.[7] Kincer, in discussing the early tabulations for New Haven and Washington, offers assurance that "the fundamental observational data are trustworthy and are of such character as to afford complete confidence in their integrity."[8] In similar vein, Milham found a "good agreement" among the data of five early New England stations (Williamstown, New Haven, Salem, New Bedford, and Cambridge) and adds that "observations of some value were probably made during 1816 (a notoriously cold year) at Castine, Sharon, Deerfield, and Philadelphia."[9]

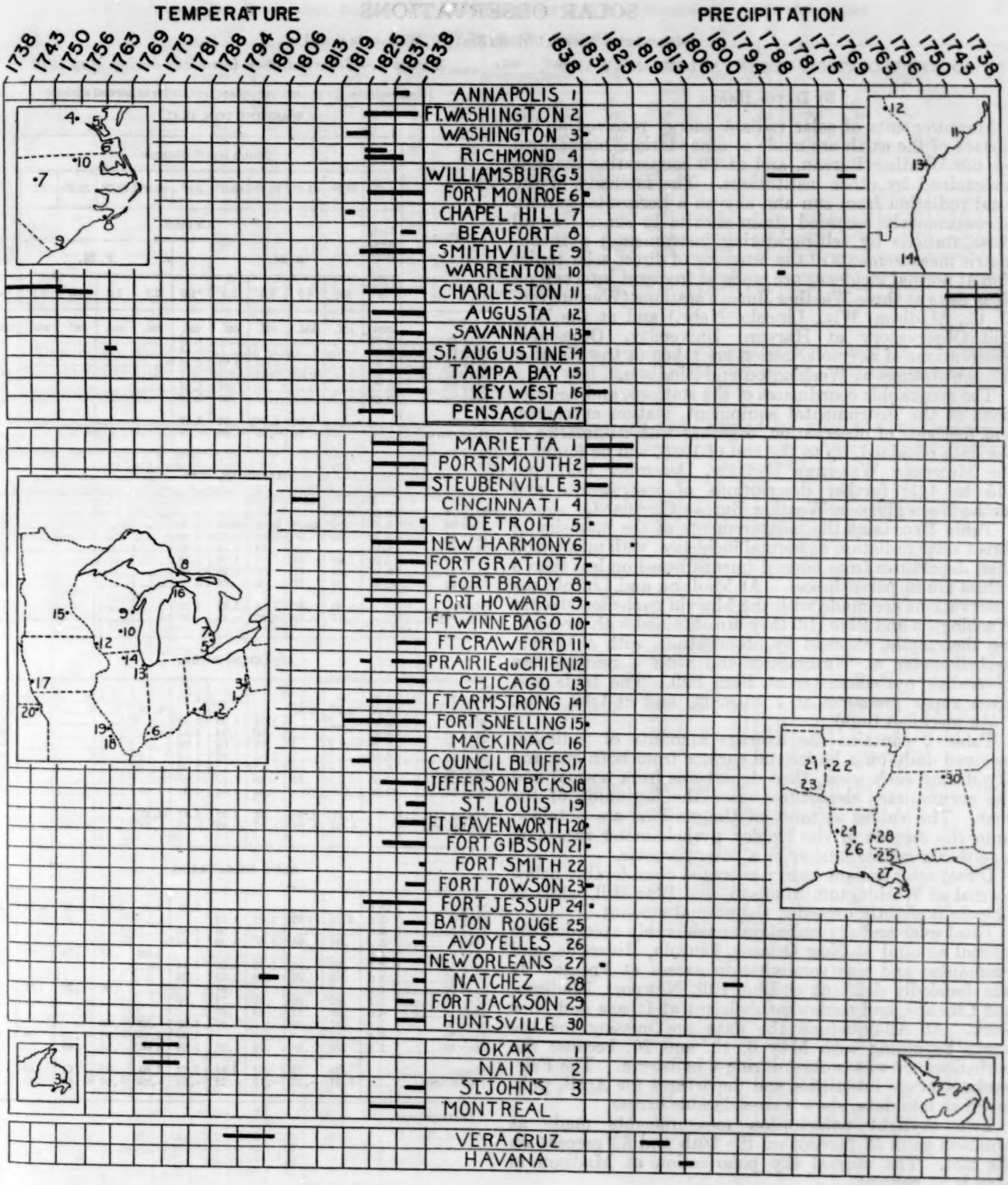
The year 1838 marks the end of the first century of instrumental recording of weather data in this country; but climatologically it has no more significance than any other year at about that time. If one were seeking epoch-making dates in this field, 1819 might logically be chosen. In that year instrumental observations were first made by the military at Fort Snelling, Minn., initiating, so to speak, the official type of record; until 1819, all the statistical material had been compiled by self-appointed observers who performed their exacting and somewhat tedious duties simply because they wanted to. Other Army posts soon followed the example of Fort Snelling; and by 1838, daily records were being made at 13 forts, mainly in the Midwest. Another advance toward an official system of weather records was effected by the system of stations organized about 1835 by the New York Board of Regents; this body encouraged the collection of data by professors and principals at the various academies and colleges in the State, a program that explains the existence of numerous New York stations during the early days. A similar system in Pennsylvania, approved in 1839, appears to have died aborning.

The value of simultaneous observations with standardized apparatus and hours of observation at many places had been recognized before 1819, however. Thomas Jefferson, in a letter to Volney in 1797 tells of his plan for supplying "some persons in every [Virginia] county" with instruments necessary for accurate observations of weather, and his hope that in due time this practice would extend to the several States, adding that "this long-winded project was prevented by the war which came upon us and since that I have been far otherwise engaged."[10] Similarly, Dr. B. S. Barton, of the University of Pennsylvania suggested in 1807 that thermometers, barometers, and rain-gages be operated by the Linnean Society of Philadelphia and that similar observations be made by the members of the society in different parts of the Union so that at some future time "a complete history of our climate might be constructed."[11]

Many may wonder as to the incentives which led so many men to undergo the daily drudgeries of instrument reading without the prospect of monetary compensation. Perhaps the reasons advanced by two such men themselves may serve as examples: Noah Webster, bothered by various conflicting theories as to the origin of dew, and seeking relaxation from his regular occupation, performed a "series of experiments" in order, simply, to ascertain the truth.[12] James Winthrop states that he carried out his observations near Cambridge from 1797 to 1803 that "I might obtain a general knowledge of our climate and its variations."[13] At a later time, such men would doubtless have become productive members of the climatological fraternity. Unfortunately, we shall never be able to construct, as Barton hoped, "a complete history of our climate," but the records referred to in this inventory, emanating largely from the desire of men to learn the truth, enable us to treat the matter to some extent, even though fragmentarily.

[6] Lorin Blodget, *Climatology of the United States*, Philadelphia and London, 1857. For an appreciation of this volume see R. deC. Ward in MO. WEA. REV., 42: 23-27, 1914.
[7] "Rainfall in New England," *Journ. New Eng. Water Works Ass'n.*, 29: 239, 1915.
[8] MO. WEA. REV. 61: 255, 1933.
[9] Willis I. Milham, "The year 1816—the causes of abnormalities," MO. WEA. REV., 52: 563-570, 1924.
[10] Letter to Volney, Jan. 8, 1797, in *Volney et l'Amérique*, The Johns Hopkins Univ. Press, p. 62, 1923.
[11] "Discourse on natural history," *Journ. Phila. Medical Soc.*, 1807, p. 61.
[12] Results published in *Memoirs Amer. Acad. of Arts and Sciences*, 3. Part I, 95-103, 1809-19.
[13] Mass. Soc. for the Promotion of Agriculture, 1804, p. 20.


TEMPERATURE
PRECIPITATION
1738 1743 1750 1756 1763 1769 1775 1781 1788 1794 1800 1806 1813 1819 1825 1831 1838
HOULTON 1
EASTPORT 2
CASTINE 3
BRUNSWICK 4
BATH 5
PORTLAND 6
PORTSMOUTH 7
DOVER 8
CONCORD 9
HANOVER 10
WILLIAMSTOWN 11
BURLINGTON 12
FAYETTEVILLE 13
RUTLAND 14
WINDSOR 15
IPSWICH 16
SALEM 17
ANDOVER 18
CHARLESTOWN 19
CAMBRIDGE 20
WATERTOWN 21
BOSTON 22
STOW 23
MEDFIELD 24
NEW BEDFORD 25
WILLIAMSTOWN 26
MENDON 27
NEWPORT 28
NEW HAVEN 29
PROVIDENCE 30
EAST HAMPTON 1
JAMAICA 2
FLATBUSH 3
GOVERNOR'S Isl. 4
WEST POINT 5
KINDERHOOK 6
ALBANY 7
WATERVLIET 8
CHERRY VALLEY 9
UTICA 10
POTSDAM 11
NORTH SALEM 12
NEWBURG 13
KINGSTON 14
AUBURN 15
LANSINGBURG 16
LOWVILLE 17
FAIRFIELD 18
ONEIDA 19
OXFORD 20
ITHACA 21
PENN YAN 22
ROCHESTER 23
MIDDLEBURY 24
FREDONIA 25
PHILADELPHIA 26
WESTCHESTER 27
FT. DELAWARE 28
BALTIMORE 29
PITTSBURGH 30


TEMPERATURE
PRECIPITATION
1738 1743 1750 1756 1763 1769 1775 1781 1788 1794 1800 1806 1813 1819 1825 1831 1838
1838 1831 1825 1819 1813 1806 1800 1794 1788 1781 1775 1769 1763 1756 1750 1743 1738
ANNAPOLIS 1
FT. WASHINGTON 2
WASHINGTON 3
RICHMOND 4
WILLIAMSBURG 5
FORT MONROE 6
CHAPEL HILL 7
BEAUFORT 8
SMITHVILLE 9
WARRENTON 10
CHARLESTON 11
AUGUSTA 12
SAVANNAH 13
ST. AUGUSTINE 14
TAMPA BAY 15
KEY WEST 16
PENSACOLA 17
MARIETTA 1
PORTSMOUTH 2
STEUBENVILLE 3
CINCINNATI 4
DETROIT 5
NEW HARMONY 6
FORT GRATIOT 7
FORT BRADY 8
FORT HOWARD 9
FT WINNEBAGO 10
FT CRAWFORD 11
PRAIRIE du CHIEN 12
CHICAGO 13
FT ARMSTRONG 14
FORT SNELLING 15
MACKINAC 16
COUNCIL BLUFFS 17
JEFFERSON B'CKS 18
ST. LOUIS 19
FT LEAVENWORTH 20
FORT GIBSON 21
FORT SMITH 22
FORT TOWSON 23
FORT JESSUP 24
BATON ROUGE 25
AVOYELLES 26
NEW ORLEANS 27
NATCHEZ 28
FORT JACKSON 29
HUNTSVILLE 30
OKAK 1
NAIN 2
ST JOHNS 3
MONTREAL
VERA CRUZ
HAVANA

244521—40——2

SOLAR OBSERVATIONS

[Meteorological Research Division, EDGAR W. WOOLARD in charge]

SOLAR RADIATION OBSERVATIONS, MAY 1940

By DAVID HABER

Measurements of solar radiant energy received at the surface of the earth are made at nine stations maintained by the Weather Bureau, and at 10 cooperating stations maintained by other institutions. The intensity of the total radiation from sun and sky on a horizontal surface is continuously recorded (from sunrise to sunset) at all these stations by self-registering instruments; pyrheliometric measurements of the intensity of direct solar radiation at normal incidence are made at frequent intervals on clear days at three Weather Bureau stations (Washington, D. C., Madison, Wis., Lincoln, Nebr.) and at the Blue Hill Observatory at Harvard University. Occasional observations of sky polarization are taken at the Weather Bureau stations at Washington and Madison.

The geographic coordinates of the stations, and descriptions of the instrumental equipment, station exposures, and methods of observation, together with summaries of the data obtained, up to the end of 1936, will be found in the MONTHLY WEATHER REVIEW, December 1937, pp. 415 to 441; further descriptions of instruments and methods are given in Weather Bureau Circular Q.

Table 1 contains the measurements of the intensity of direct solar radiation at normal incidence, with means and their departures from normal (means based on less than 3 values are in parentheses). At Madison and Lincoln the observations are made with the Marvin pyrheliometer; at Washington and Blue Hill they are obtained with a recording thermopile, checked by observations with a Marvin pyrheliometer at Washington and with a Smithsonian silver-disk pyrheliometer at Blue Hill. The table also gives vapor pressures at 7:30 a. m. and at 1:30 p. m. (75th meridian time).

Table 2 contains the average amounts of radiation received daily on a horizontal surface from both sun and sky during each week, then departures from normal and the accumulated departures since the beginning of the year. The values at most of the stations are obtained from the records of the Eppley pyrheliometer recording on either a microammeter or a potentiometer.

Direct solar radiant energy averaged considerably below normal at Washington, Madison, and Blue Hill, while at Lincoln it slightly exceeded the normal amount.

Total solar and sky radiation considerably exceeded the normal amount at New Orleans, Lincoln, Riverside, and Fairbanks, and was somewhat in excess at Fresno. It was decidedly deficient at Blue Hill, Newport, Madison, and Chicago, and somewhat deficient at Ithaca and New York. At Albuquerque the data are missing for the weeks beginning with May 6, 13, and 20, because the pyrheliometer was broken during a hailstorm. The Fairbanks average intensities and departures for April, published as late data, show a considerable excess.

Two skylight polarization measurements made at Madison gave 58 percent on the 20th and 53 percent on the 23d. The normal sky polarization at Madison in May is 57 percent.

TABLE 1.—*Solar radiation intensities during May 1940*

[Gram-calories per minute per square centimeter of normal surface]

WASHINGTON, D. C.

Date	Sun's zenith distance: 7:30 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	1:30 p. m.
	75th mer. time	Air mass: A. M.					P. M.				Local mean solar time
	e	5.0	4.0	3.0	2.0	*1.0	2.0	3.0	4.0	5.0	e
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
May 5	5.56					1.45					5.79
May 13	7.29					1.06					7.29
May 17	7.87				0.91	1.12					7.04
May 18	7.87		0.58	0.69							9.14
May 28	10.21				.91	1.14					8.48
May 29	10.59				.91	1.16					9.47
Means			(.58)	(.69)	.91	1.19					
Departures			−.14	−.15	−.09	−.09					

MADISON, WIS.

May 11	5.56	0.69									6.02
May 14	9.83	.32	0.48	0.60	0.88	1.16					12.24
May 17	5.79	.48	.60	.81	1.02	1.29					7.04
May 20	8.18			.94	1.14	1.39					8.18
May 23	7.29	.45	.54	.75	1.10	1.36					4.57
May 25	6.76	.61	.71	.88	1.18	1.41					7.87
May 31	10.21	.36	.47	.58	.86	1.10					10.21
Means		.48	.56	.76	1.03	1.28					
Departures		−.15	−.23	−.22	−.08	−.09					

LINCOLN, NEBR.

May 2	3.81					1.50					3.63
May 9	6.50	0.77	0.85				1.23				7.29
May 10	8.18			1.04	1.20	1.42					8.18
May 22	6.27			.96	1.20	1.44					5.56
May 23	7.29			.79	1.02	1.29					4.37
May 27	5.56			1.05	1.22	1.48					6.76
May 28	6.02					1.36					6.59
May 29	7.29		.74	.89	1.11	1.43					7.57
May 31	10.59			.84	1.04	1.39	1.00				11.38
Means		(.77)	(.80)	.93	1.13	1.41	(1.12)				
Departures		+.10	+.01	+.01	+.01	+.03	+.01				

BLUE HILL, MASS.

May 3	10.6					1.35	1.10	0.95	0.82	0.73	10.7
May 6	5.2	0.80	0.89	1.02	1.12						3.2
May 7	5.8				1.20	1.45					4.4
May 8	5.2	.84	.94	1.07	1.22	1.44					2.3
May 9	4.6						1.06	.87	.74	.67	3.6
May 10	3.5	.86	.96	1.08	1.18	1.44					3.2
May 13	3.6	.68	.76	.88	1.02	1.33					3.0
May 14	7.4				.81			.88	.78	.67	7.1
May 15	7.1	.40	.50	.61	.75	.99					6.1
May 18	6.3	.38	.51	.68	.87						6.5
May 19	7.1	.47	.58		.97	1.29	.87	.60			6.3
May 29	7.4					1.36	1.15	.97	.79	.68	7.1
May 30	5.6	.52	.62	.74	.93	1.28	1.01	.83	.69		5.8
Means		.62	.72	.87	1.01	1.33	1.04	.85	.76	.69	
Departures		+.01	−.15	−.17	−.10	−.03	−.05	−.05	−.01	.00	

*Extrapolated.

TABLE 2.—*Average daily totals of solar radiation (direct + diffuse) received on a horizontal surface*

[Gram-calories per square centimeter]

Week beginning—	Washington	Madison	Lincoln	Chicago	New York	Fresno	Albuquerque	Fairbanks	La Jolla	Miami	New Orleans	Riverside	Blue Hill	Newport	Friday Harbor	Ithaca	Cambridge
	cal.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Apr. 29	467	375	605	318	430	666	772	464	600	528	500	582	386	435	462	365	386
May 6	581	449	562	494	571	685	.....	521	555	526	565	618	505	564	519	508	610
May 13	552	370	477	321	464	651	.....	432	494	509	556	580	417	474	500	365	478
May 20	313	506	500	358	226	605	.....	458	461	495	505	532	209	244	666	453	184
May 27	498	505	636	429	413	701	785	613	598	407	509	584	439	499	576	396	468
DEPARTURES FROM WEEKLY NORMALS																	
Apr. 29	−3	−70	+125	−74	+21	+32	.....	+57	+12	+16	+88	+26	−92	−56	−79	−15	.....
May 6	+121	−2	+103	+81	+166	+36	.....	+63	−11	+11	+144	+66	+89	+45	−35	+87	.....
May 13	+77	−107	−41	−102	+39	−16	.....	−37	−18	+14	+132	+60	−97	−24	+10	−73	.....
May 20	−184	+11	+34	−95	−206	+17	.....	+8	−22	−5	+81	−18	−273	−239	+90	−29	.....
May 27	−20	+7	+103	−43	−56	+12	.....	+157	+56	−56	+24	+28	−122	−45	+18	−60	.....
ACCUMULATED DEPARTURES ON JUNE 2																	
	−742	+385	−1,526	−266	+2,590	−1,470	.....	+3,115	−1,421	+2,534	+5,124	−2,205	−1,981	−2,359	+2,849	.....	.....

LATE DATA

The mean daily total solar and sky radiation in gram-calories per square centimeter received on a horizontal surface at Fairbanks for the weeks beginning with April 1, 8, 15, and 22 are, respectively, 352, 390, 356, and 495, with corresponding departures +14, +24, −16, and +121.

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.), Superintendent, U. S. Naval Observatory. Data from measurements at the U. S. Naval Observatory from plates obtained at the observatories indicated. Difference in longitude is measured from the central meridian, positive toward the west. Latitude is positive toward the north. Areas are corrected for foreshortening and expressed in millionths of Sun's hemisphere. For each day below longitude, latitude, area of spot or groups, and spot count, are given, respectively, the assumed longitude of the center of the disk, assumed latitude of the center of the disk, total area of spots and groups, and total spot count]

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1940	h m		°	°	°	°				
May 1	9 5	(*)	−48	329	−9	48	6	1	G	Mt. Wilson.
		6826	−42	335	+9	44	24	4		
		(*)	−15	2	−8	16	12	1		
		(*)	−9	8	−11	12	6	2		
		6824	+4	21	+9	12	97	7		
		6825	+15	32	−14	19	12	5		
		6818	+86	103	−3	86	97	1		
				(17)	(−4)		254	21		
2	10 46	6827	−35	328	+8	37	6	1	G	Do.
		6826	−30	333	+9	33	24	4		
		(*)	−30	333	−21	34	6	3		
		6824	+18	21	+10	23	48	7		
		6825	+30	33	−13	32	6	1		
				(3)	(−4)		90	16		
3	8 45	6826	−18	333	+9	23	12	1	G	Do.
		6824	+31	22	+10	34	73	12		
		6825	+41	32	−13	42	24	6		
				(351)	(−4)		109	19		
4	9 47	(*)	−44	293	+20	50	6	3	VG	Do.
		6827	−10	327	+10	17	24	5		
		6826	−4	333	+9	14	48	14		
		6824	+45	22	+10	47	24	11		
		6825	+56	33	−13	56	24	4		
				(337)	(−4)		119	37		
5	8 56	6826	+10	334	+9	17	97	22	G	Do.
		6824	+59	23	+10	60	24	4		
				(324)	(−4)		121	26		
6	11 30	6827	+18	327	+12	24	36	4	G	U. S. Naval.
		6826	+23	332	+12	27	206	19		
		(*)	+25	334	−14	26	6	1		
		6828	+57	6	−9	57	6	1		
				(309)	(−4)		254	25		
7	11 47	6827	+30	326	+12	33	73	8	VG	Do.
		6826	+37	333	+12	41	194	14		
				(296)	(−3)		267	22		
8	11 20	6830	−51	232	−9	52	36	7	G	Do.
		6829	−25	258	−17	32	48	8		
		6827	+46	329	+12	49	97	15		
		6826	+52	335	+12	54	97	1		
				(283)	(−3)		278	31		

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1940	h m		°	°	°	°				
May 9	8 48	6832	−65	206	−8	65	24	1	VG	Mt. Wilson.
		6830	−37	234	−9	38	48	16		
		6831	0	271	+5	8	12	1		
		(*)	+35	306	−9	36	6	1		
		6827	+60	331	+11	62	97	12		
		6826	+65	336	+11	66	97	5		
				(271)	(−3)		284	36		
10	11 23	6832	−51	206	−9	52	145	4	G	U. S. Naval.
		6830	−23	234	−10	23	121	11		
		6827	+73	330	+11	73	73	1		
		6826	+81	338	+10	81	24	3		
				(257)	(−3)		363	19		
11	11 10	6832	−44	200	−13	46	6	4	G	Do.
		6832	−38	206	−9	40	339	27		
		6830	−9	235	−12	12	73	8		
		6827	+88	332	+11	88	48	1		
				(244)	(−3)		466	40		
12	12 8	6835	−84	146	+13	84	339	1	F	Do.
		6835	−90	150	+12	80	97	1		
		6832	−24	206	−7	24	339	14		
		6834	−14	216	−11	16	48	6		
		6830	+6	236	−9	8	97	8		
		6829	+30	260	−18	33	6	1		
		6833	+58	288	−14	60	6	2		
				(230)	(−3)		932	33		
13	11 16	6836	−83	134	+14	83	485	5	VG	Do.
		6835	−70	147	+13	70	145	1		
		6835	−67	150	+12	67	388	1		
		6832	−11	206	−8	13	291	18		
		6834	−1	216	−10	7	97	9		
		6830	+17	234	−9	18	194	16		
		6833	+72	289	−14	72	48	1		
				(217)	(−3)		1,648	51		
14	11 0	6836	−68	136	+15	68	436	4	G	Do.
		6835	−58	146	+14	60	194	1		
		6835	−54	150	+13	54	291	2		
		6938	−27	177	+9	30	48	6		
		(*)	−17	187	+9	22	24	1		
		6832	+2	206	−8	6	267	10		
		6837	+2	206	−11	9	24	2		
		6834	+11	215	−10	13	85	2		
		6834	+16	220	−11	17	12	2		
		6830	+30	234	−9	31	291	20		
				(204)	(−3)		1,672	50		
15	11 13	6836	−54	137	+15	58	436	6	VG	Do.
		6835	−44	147	+14	47	194	2		
		6835	−40	151	+12	43	267	1		
		6838	−11	180	+9	16	24	3		
		6832	+16	207	−8	17	255	20		
		6837	+16	207	−11	18	61	11		
		6834	+25	216	−9	25	48	1		
		6830	+44	235	−8	44	194	17		
				(191)	(−3)		1,479	61		

POSITIONS AND AREAS OF SUN SPOTS—Continued.

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1940	h m		°	°	°	°				
May 16	8 41	6836	−42	137	+15	45	436	13	VG	Mt. Wilson.
		6835	−29	150	+14	34	145	3		
		6835	−26	153	+13	20	291	12		
		6838	+1	180	+9	12	48	6		
		6837	+29	208	−10	30	97	18		
		6832	+30	209	−8	31	194	26		
		6834	+38	217	−9	39	24	1		
		6830	+58	237	−8	58	242	34		
				(179)	(−2)		1,477	113		
17	11 44	6836	−29	135	+15	33	388	15	G	U. S. Naval.
		6835	−17	147	+14	24	97	4		
		6835	−13	151	+12	20	291	15		
		6838	+15	179	+10	19	12	2		
		6832	+45	209	−8	45	218	16		
		6837	+45	209	−10	46	24	1		
		(*)	+51	215	−9	51	12	1		
		6839	+60	224	−14	61	12	2		
		6830	+70	234	−9	70	388	15		
				(164)	(−2)		1,442	71		
18	8 46	6836	−15	137	+16	23	436	16	VG	Mt. Wilson.
		6835	−5	147	+15	18	73	4		
		6835	−1	151	+12	14	218	8		
		6840	+19	171	+17	27	97	5		
		6832	+57	209	−7	57	97	11		
		6837	+58	210	−11	58	24	1		
		6830	+81	233	−9	81	48	3		
				(152)	(−2)		993	48		
19	11 38	6842	−25	112	−9	27	6	1	VG	U. S. Naval.
		6836	−1	136	+16	18	388	25		
		6841	+9	146	−8	11	6	1		
		6835	+10	147	+15	20	73	4		
		6835	+13	150	+13	20	194	10		
		6840	+30	167	+17	35	12	1		
		6840	+36	173	+17	41	48	10		
		6832	+71	208	−7	71	48	8		
		6837	+71	208	−11	71	6	1		
				(137)	(−2)		781	61		
20	12 2	6843	−73	51	−7	73	48	4	F	Do.
		6842	−10	114	−9	13	97	8		
		6836	+12	136	+15	21	291	11		
		6841	+22	146	−8	23	6	1		
		6835	+23	147	+15	28	48	1		
		6835	+27	151	+12	31	194	6		
		6840	+50	174	+16	53	48	10		
		6832	+82	206	−7	82	6	1		
				(124)	(−2)		738	42		
21	10 40	6845	−79	33	−12	79	6	6	VG	Do.
		6843	−59	53	−7	59	206	7		
		6842	+3	115	−10	8	97	18		
		(*)	+4	116	−25	24	6	1		
		6836	+25	137	+16	31	315	22		
		6835	+37	149	+15	41	48	1		
		6835	+40	152	+12	43	121	6		
		6840	+62	174	+16	64	48	15		
				(112)	(−2)		847	76		
22	10 53	6845	−67	31	−11	68	24	5	G	Do.
		6844	−57	41	+24	62	24	2		
		6843	−45	53	−7	46	315	15		
		6842	+17	115	−10	19	61	9		
		6836	+38	136	+16	42	291	9		
		6835	+50	148	+15	52	48	1		
		6835	+54	152	+12	55	121	4		
		6840	+75	173	+16	76	36	6		
				(98)	(−2)		920	51		
23	8 45	6847	−85	1	−10	85	582	1	VG	Mt. Wilson
		6846	−75	11	−17	76	97	8		
		6845	−56	30	−12	57	24	4		
		6844	−45	41	+23	50	61	8		
		6843	−32	54	−7	33	339	40		
		6842	+29	115	−11	31	145	21		
		6836	+51	137	+15	54	291	9		
		6835	+65	151	+14	66	24	2		
		6835	+70	156	+11	71	97	2		
		6840	+88	174	+16	88	24	4		
				(86)	(−2)		1,684	99		
24	13 5	6847	−70	0	−11	71	485	2		Do.
		6846	−60	10	−17	62	48	1	P	
		6845	−37	33	−11	38	12	1		
		6844	−31	39	+22	39	48	1		
		6843	−16	54	−7	17	145	6		
		6842	+42	112	−10	43	48	3		
		6836	+64	134	+15	66	242	1		
		6835	+81	151	+11	81	24	1		
				(70)	(−2)		1,052	16		

POSITIONS AND AREAS OF SUN SPOTS—Continued.

Date	Eastern standard time	Mount Wilson group No.	Heliographic: Difference in longitude	Heliographic: Longitude	Heliographic: Latitude	Heliographic: Distance from center of disk	Area of spot or group	Spot count	Plate quality	Observatory
1940	h m		°	°	°	°				
May 25	11 46	6847	−58	0	−10	58	388	2	P	Mt. Wilson.
		6845	−22	36	−12	23	145	12		
		6844	−15	43	+22	27	48	1		
		6843	−1	57	−7	6	145	5		
		6836	+80	138	+14	80	194	1		
				(58)	(−1)		920	21		
26	16 3	6847	−41	1	−11	42	388	10	G	U. S. Naval.
		6845	−6	36	−12	12	145	18		
		6844	−1	41	+22	23	24	7		
		6843	+11	53	−7	14	12	8		
		6843	+18	60	−6	19	97	7		
				(42)	(−1)		666	50		
27	11 14	6847	−30	2	−10	31	461	10	VG	Do.
		6845	+6	38	−12	12	194	21		
		6844	+9	41	+22	25	48	5		
		6843	+30	62	−6	31	73	3		
				(32)	(−1)		776	39		
28	11 13	6848	−75	304	−5	75	6	2	VG	Do.
		6847	−20	359	−10	22	73	18		
		6847	−12	7	−10	15	364	1		
		6845	+17	36	−12	20	242	23		
		6844	+19	38	+22	30	48	11		
		6843	+42	61	−6	43	48	10		
				(19)	(−1)		781	65		
29	11 8	6848	−62	303	−7	62	24	4	VG	Do.
		6847	−8	357	−11	13	48	11		
		6849	−6	359	+11	13	24	6		
		6847	0	5	−10	9	339	1		
		6844	+30	35	+23	37	48	15		
		6845	+30	35	−12	32	291	24		
		6843	+56	61	−6	56	12	3		
				(5)	(−1)		786	64		
30	9 3	6848	−48	305	−7	48	36	2	VG	Mt. Wilson.
		6847	+4	357	−11	11	48	13		
		6849	+8	1	+11	14	24	7		
		6847	+12	5	−10	15	315	1		
		6844	+44	37	+23	50	24	2		
		6845	+45	38	−12	46	388	35		
		6843	+70	63	−6	70	6	1		
				(353)	(−1)		841	61		
31	11 3	6848	−34	305	−6	35	48	9	VG	U. S. Naval.
		6847	+27	6	−10	28	291	1		
		6845	+59	38	−12	60	388	12		
		6844	+61	40	+22	64	48	6		
				(339)	(−1)		775	28		

Mean daily area for 31 days = 768.

*=not numbered.
VG=very good; G=good; F=fair; P=poor.

PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR MAY 1940

[Dependent alone on observations at Zurich, Switzerland]
[Date furnished through the courtesy of Prof. W. Brunner, Eidgen Sternwarte, Zurich, Switzerland]

May 1940	Relative numbers	May 1940	Relative numbers	May 1940	Relative numbers
1	*Eac* 26	11	36	21	*Eac* 71
2	28	21	*Macd* 53	22	86
3	23	13	*a* 62	23	*d* 85
4	25	14	*a* 93	24	67
5	*a* —	15	91	25	57
6	21	16	85	26	*a* 61
7	22	17	—	27	62
8	*Ec* 32	18	*a* 63	28	*a* —
9	*Ec* 31	19	*a* 69	29	—
10	34	20	*Mc* 61	30	54
				31	*Eac* 76

Means, 27 days = 54.6

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central-circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE in charge]

By EARL C. THOM

The weather during May was warmer than normal over the western half of the United States and also over the extreme northeastern section. The largest departures from normal, about 8° F., occurred in the area of northwestern Utah, extreme southern Idaho and northeastern Nevada. Cooler weather than usual for the month was experienced over the remainder of the country, with the temperature in Indiana and extreme eastern Illinois 4° below normal.

The direction of the resultant winds during May was considerably north of normal (clockwise turning) over the eastern half of the country, and south of normal over the western section at the 1,500-meter level. At the 3,000-meter level the tendency for resultant winds to be more northerly than normal extended over all of the country except along the north Pacific coast and in the extreme south Florida area. At the 5,000-meter level the direction of the resultant wind was north of the 5 a. m. normal over the central part of the United States and was south of this normal in the western part of the United States and along the Atlantic coast. At the 1,500- and 3,000-meter levels the resultant velocities were somewhat above normal in the extreme northwestern and in the southeastern parts of the country. At the 5,000-meter level, higher than normal resultant velocities prevailed generally, especially over the central portion of the country where plus departures of between 5.5 and 6.1 meters per second obtained.

Winds at lower levels were in general more northerly than normal in the areas having below normal temperatures. This tendency has continued since the beginning of last winter.

The change in resultant wind direction from 5 a. m. to 5 p. m. during May at the 1,500-meter level was counterclockwise over a considerable portion of the United States. The opposite shift was, however, shown at this level over the plateau eastward from Medford, over the West Central and North Central States, along the eastern coast of the Gulf of Mexico, and at New York. At the 3,000-meter level, less of the area showed the counterclockwise shift of resultant winds between 5 a. m. and 5 p. m. At this level the shift to the northward occurred in the extreme southwest, in Colorado, in most of the extreme southeast and at Sault Ste. Marie. No well-defined tendency was shown in the change in resultant velocity between 5 a. m. and 5 p. m. at the 1,500-meter level in May. At the 3,000-meter level the 5 p. m. resultant velocity was somewhat higher than the corresponding 5 a. m. velocity over the eastern part of the United States and over the Pacific coast region, and somewhat lower over the plateau and portions of the Plains States.

Mean barometric pressure at the 5,000-foot level (chart VIII) was lowest over Sault Ste. Marie (840.6 mb.) during the month of May and was highest over Pensacola, Fla., (851.6 mb.). The mean pressure gradient at this level over the plains and mountains of the west was small, there being but slightly over 2 mb. difference between any two points in the area west of 100° west longitude. At somewhat higher levels (table 1) the highest pressure occured over Miami and the lowest over the eastern Great Lakes. At the 1,500-meter level and higher, the mean pressures were higher during May over all parts of the United States than during April. The greatest increase in mean pressure from April to May was over the northern half of the United States, there being an average increase of 8 millibars at the 10,000-meter level, with the largest single increase of 11 millibars occurring over Sault Ste. Marie, at that level. The smallest increase in pressure at upper levels occurred over the extreme southeastern part of the country.

The steepest mean pressure gradient over the United States in May occurred at the 7,000-meter level. At this level the pressure over Miami was 430 mb., and over Sault Ste. Marie was 410 mb.

May was warmer than April at all levels below 12,000 meters, except slightly colder at the 11,000-meter level at Pensacola and at Buffalo. It was colder in May than in April at the 12,000- and 13,000-meter levels over most of the country, the warmer than April tendency still holding over considerable of the southwest and the extreme west central regions and over an area in the east and north central part of the country. At 14,000 meters the temperatures in May were lower than in April except over the western Great Lake region and over southern Florida. At the 15,000-, 16,000- and 17,000-meter levels the May temperatures became successively higher than in April except in the Northwestern and West Central States and over the New England area, while at 18,000 meters the same or higher temperatures were everywhere noted except at El Paso and over New England.

At levels below 10,000-meters the temperatures in May were lower than during May of the previous year except in the Northwest and along the Pacific coast. At the 10,000- and 11,000-meter levels the temperatures were colder than in May 1939 over the entire country. At the next five higher levels the eastern half of the country shows an increase in temperature over the previous May. At Atlanta, Ga., for example, the change was −0.8°, −0.4°, +1.0°, +2.9°, and +4.0° for these five levels, respectively.

The altitude of the surface of mean freezing temperature for the month increased to the southward across the eastern part of the United States, the altitude of this surface was 2,200 meters at Sault Ste. Marie, 2,700 meters at Chicago, 3,400 meters at Nashville, 4,000 meters at Pensacola, and 4,400 meters at Miami. There was also an upward slope of this surface to the southwestward, the altitude being 2,600 meters at Minneapolis, 3,800 meters at Denver and 4,300 meters at Phoenix. The altitude of the mean freezing surface is much higher over the Plateau, Rocky Mountains, and west coast than it is at corresponding latitudes over the eastern half of the country. The elevation of this surface was 2,900 meters at Spokane, 3,600 meters at Boise, 4,000 meters at Ely, and 4,300 meters at Phoenix. The altitude of the mean freezing temperature at Ely was 4,000 meters, while at Lakehurst at about the same degree of latitude the altitude was 3,000 meters.

The minimum temperatures for the United States (table 1) were observed at the 12,000-meter level over Bismarck, N. Dak., Minneapolis, Minn., and Sault Ste. Marie, Mich. The minimum temperature occurred at the 13,000-meter level over the Northwestern States, over the west central area extending as far southward as Oklahoma City, over the southern Great Lake region, and over the New England States. The minimum occurred at 17,000 meters over the Southeastern States and along the southern border except at San Diego, where the level of minimum temperature was at 14,000 meters. The

lowest minimum temperature recorded over the United States in May was −68.6° at the 17,000-meter level over Miami, while the highest minimum was −55.4° over Minneapolis at the 12,000-meter level. Two Alaska stations, Fairbanks and Juneau, are also included in table 1. At these stations the minimum temperature occurred at the 10,000-meter level, with the higher minimum, −52.2°, recorded at Fairbanks.

Tropopause data for May showing the mean altitudes and temperatures of the tropopause at various stations are shown in table 4 and on chart XIII.

Table 3 shows the maximum free-air wind velocities and their direction for various sections of the United States during May, as determined by pilot balloon observations. The extreme maximum for the month was 62 meters per second (149 miles per hour) reported on May 3 from the WSW, over Winnemucca at a height of 8,620 meters (nearly 5½ miles) above sea level.

MEAN MONTHLY ISENTROPIC CHART [1]

On the mean isentropic chart (θ=310°) for May 1940 there appear two marked moist tongues. The one over the Southwestern States is part of a large anticyclonic eddy the dry tongue of which is found over the East Gulf States. The other seasonal moist tongue is evident at the southern tip of Florida.

The steep slope of the isentropic surface in the Southwest together with the inflow of moisture caused above normal precipitation over several portions of the Southwestern States. But the widespread above-normal precipitation in the lake region and in the northeastern section of the country probably resulted from motion in a lower isentropic surface, since the 310° surface is rather high in this area (about 550 millibars).

[1] Prepared by Division of Education and Research.

TABLE 1.—*Mean free-air barometric pressure (P.) in millibars, temperature (T.) in degrees Centigrade, and relative humidities (R. H.) in percent, obtained by airplanes and radiosondes during May 1940*

Stations and elevations in meters above sea level

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Billings, Mont. (1,089 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (864 m.)				Buffalo, N. Y. (220 m.)				Charleston, S. C. (14 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	31	838	16.9	39	31	980	16.5	68	30	892	13.4	54	31	956	9.6	73	31	915	13.9	55	28	987	9.4	86	31	1,013	16.4	86
500					31	957	17.7	61													28	955	10.9	73	31	958	18.1	67
1,000					31	903	15.3	56					31	901	11.9	58	31	900	17.0	47	28	899	8.9	68	31	903	15.4	61
1,500					31	851	12.4	57	30	849	13.0	49	31	849	9.1	56	31	849	16.0	38	28	846	6.0	69	31	851	12.5	59
2,000	31	801	16.6	36	31	801	9.3	59	30	800	10.0	48	31	798	5.8	58	31	800	12.3	38	28	796	3.1	71	31	801	9.8	59
2,500	31	755	13.5	36	31	754	6.3	60	30	752	6.5	50	31	751	2.7	57	31	753	8.4	39	27	748	0.2	70	31	754	6.9	57
3,000	31	711	9.9	38	31	709	3.5	55	30	708	2.6	53	31	706	0.0	52	31	709	4.7	39	27	702	−2.4	69	31	709	4.2	55
4,000	30	629	2.0	43	31	626	−2.3	48	29	625	−4.8	59	31	622	−6.2	48	31	626	−2.9	42	26	618	−7.9	63	31	627	−1.7	53
5,000	30	555	−5.9	48	31	551	−8.3	44	29	550	−11.6	57	31	547	−12.1	44	31	551	−10.2	43	26	544	−13.7	56	31	552	−7.5	47
6,000	30	488	−12.9	48	31	484	−14.8	40	28	482	−18.1	54	31	479	−19.1	40	31	483	−17.0	44	26	476	−20.3	52	30	485	−13.9	43
7,000	30	427	−19.6	45	30	423	−22.0	37	28	420	−25.2	52	31	418	−26.8	39	31	422	−23.9	43	26	415	−27.8	50	30	424	−21.0	40
8,000	29	373	−27.3	42	30	369	−29.8	36	28	365	−32.8	51	29	362	−34.6	40	31	368	−31.7	43	26	360	−35.4	49	29	370	−28.8	38
9,000	29	323	−35.5	41	30	320	−37.3	36	27	316	−40.8	----	29	314	−42.4	----	31	318	−39.6	43	26	311	−42.8	----	29	320	−36.8	36
10,000	29	280	−43.8	----	30	276	−44.9	----	27	272	−48.8	----	27	270	−49.9	----	31	274	−47.5	----	26	268	−50.0	----	29	277	−44.4	----
11,000	28	241	−51.6	----	29	237	−51.9	----	27	233	−55.7	----	25	231	−55.7	----	31	235	−54.9	----	26	230	−55.7	----	29	238	−51.4	----
12,000	28	205	−58.6	----	29	203	−57.5	----	27	199	−60.5	----	22	197	−58.7	----	31	201	−59.9	----	26	196	−59.1	----	29	204	−57.5	----
13,000	28	175	−62.7	----	28	173	−61.2	----	27	170	−61.2	----	22	168	−57.9	----	30	171	−61.5	----	25	167	−59.5	----	29	174	−61.4	----
14,000	27	149	−63.0	----	28	147	−61.7	----	26	144	−59.1	----	21	143	−56.2	----	29	146	−60.3	----	22	142	−57.7	----	28	148	−61.7	----
15,000	27	127	−62.3	----	27	125	−60.8	----	25	123	−58.7	----	18	122	−55.9	----	28	124	−58.8	----	22	121	−57.3	----	28	126	−61.8	----
16,000	27	108	−62.9	----	25	107	−62.1	----	25	105	−58.5	----	14	104	−56.4	----	27	106	−58.4	----	21	104	−57.6	----	27	107	−62.3	----
17,000	27	92	−63.1	----	24	91	−62.6	----	25	89	−58.0	----	9	89	−56.3	----	25	90	−57.6	----	20	88	−58.1	----	24	91	−62.9	----
18,000	27	78	−62.8	----	23	77	−61.8	----	19	76	−57.1	----	9	76	−56.2	----	22	77	−57.0	----	12	75	−57.9	----	22	77	−62.0	----
19,000	22	66	−60.9	----	14	66	−59.4	----	14	65	−56.5	----	5	65	−55.6	----	11	66	−56.3	----	8	64	−57.1	----	12	65	−60.0	----
20,000	14	56	−59.0	----					9	55	−55.7	----									5	55	−56.7	----				
21,000	5	48	−58.3	----																								

Stations and elevations in meters above sea level

Altitude (meters) M. S. L.	Denver, Colo. (1616 m.)				El Paso, Texas (1193 m.)				Ely, Nevada (1908 m.)				Fairbanks, Alaska (153 m.)				Joliet, Ill. (178 m.)				Juneau, Alaska (49 m.)				Lakehurst, N. J.[1] (39 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	31	840	11.2	70	31	881	21.0	32	31	809	10.0	45	31	991	12.8	44	29	991	9.6	84	31	1,010	9.2	73	31	1008	11.6	83
500													31	951	10.5	45	29	954	11.1	72	31	956	6.6	75	31	954	12.6	64
1,000													31	895	6.6	47	29	898	8.9	70	30	899	3.0	78	31	899	11.3	59
1,500													31	842	2.4	50	29	845	6.4	71	30	845	−0.5	79	31	846	8.0	61
2,000	31	802	12.2	61	31	802	18.1	31	31	800	12.2	42	31	791	−1.8	55	29	795	3.7	71	29	793	−3.9	80	31	796	5.7	63
2,500	31	755	9.1	59	31	756	14.3	32	31	754	11.6	37	31	742	−5.6	60	28	747	1.0	72	27	744	−7.0	78	31	748	2.8	62
3,000	31	710	5.7	60	31	712	10.1	33	31	710	7.9	37	31	696	−9.1	61	28	702	−1.6	69	27	697	−10.0	76	31	703	0.3	58
4,000	31	628	−1.0	61	29	630	1.8	38	31	628	−0.1	40	31	610	−16.0	58	28	618	−6.6	62	27	612	−16.2	70	31	620	−5.4	54
5,000	31	553	−7.9	59	29	556	−6.0	43	30	553	−7.8	44	31	534	−23.0	55	28	544	−12.9	57	26	535	−22.9	66	30	545	−11.6	53
6,000	30	485	−14.4	54	29	489	−13.0	44	30	486	−14.4	41	31	465	−30.1	55	28	476	−19.7	53	26	466	−29.9	63	30	477	−18.0	51
7,000	30	425	−21.3	51	28	428	−19.9	40	29	425	−21.9	40	29	403	−37.8	53	28	415	−27.5	52	25	403	−37.5	63	30	417	−25.7	54
8,000	30	370	−28.7	48	28	374	−27.7	38	28	370	−29.8	39	28	348	−44.6	----	28	360	−35.2	51	25	348	−44.3	----	30	363	−33.2	54
9,000	29	321	−36.8	48	28	324	−35.5	37	26	321	−38.1	38	27	299	−50.7	----	26	312	−42.6	----	23	299	−50.4	----	29	314	−40.6	----
10,000	29	278	−44.9	----	28	280	−43.0	----	26	277	−46.4	----	27	256	−52.2	----	25	268	−48.4	----	23	256	−53.5	----	29	271	−47.7	----
11,000	27	238	−52.8	----	28	241	−50.5	----	26	238	−54.3	----	27	220	−51.0	----	25	230	−52.3	----	21	220	−52.1	----	27	232	−53.6	----
12,000	27	204	−59.5	----	28	206	−57.1	----	26	203	−60.5	----	27	188	−48.0	----	23	197	−55.3	----	20	188	−50.1	----	27	198	−57.5	----
13,000	26	173	−63.4	----	28	176	−62.4	----	24	173	−62.9	----	27	162	−46.9	----	20	168	−56.2	----	18	161	−49.0	----	27	170	−59.0	----
14,000	22	147	−62.6	----	26	150	−63.6	----	24	147	−62.0	----	26	139	−46.8	----	17	144	−55.0	----	18	138	−48.9	----	27	145	−58.9	----
15,000	21	125	−61.2	----	26	127	−63.6	----	22	125	−60.9	----	26	120	−46.9	----	16	122	−55.2	----	17	118	−48.9	----	25	124	−58.4	----
16,000	21	107	−60.9	----	24	108	−64.8	----	20	107	−60.7	----	22	103	−47.0	----	13	104	−55.5	----	15	102	−49.0	----	21	106	−58.2	----
17,000	21	91	−59.9	----	19	92	−65.6	----	18	91	−60.5	----	17	88	−47.0	----	12	89	−55.3	----	11	87	−49.1	----	20	90	−58.0	----
18,000	18	78	−59.1	----	9	78	−65.5	----	13	77	−59.3	----	10	76	−47.0	----	10	76	−54.7	----	8	78	−49.2	----	16	77	−57.6	----
19,000	14	66	−58.2	----					7	66	−58.5	----	5	65	−46.7	----	7	65	−54.2	----	7	64	−49.2	----	12	66	−56.9	----
20,000																	6	55	−53.6	----					8	56	−56.1	----

See footnotes at end of table.

TABLE 1.—*Mean free-air barometric pressure (P.) in millibars, temperature (T.) in degrees Centigrade, and relative humidities (R. H.) in percent, obtained by airplanes and radiosondes during May 1940*—Continued

Altitude (meters) M. S. L.	Stations and elevations in meters above sea level																							
	Medford, Oreg. (401 m.)				Miami, Fla. (4 m.)				Minneapolis, Minn. (263 m.)				Nashville, Tenn. (180 m.)				Norfolk, Va.[1 2] (10 m.)				Oakland, Calif. (2 m.)				Oklahoma City, Okla. (391 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	31	968	15.3	59	31	1,015	20.1	84	31	981	11.2	70	30	993	14.7	77	24	1,016	16.1	75	31	1,015	13.5	81	31	969	17.5	71
500	31	956	15.7	56	31	959	20.1	75	31	954	10.8	67	30	956	16.3	66	24	959	17.0	56	31	957	12.2	81	31	956	18.0	64
1,000	31	902	13.6	54	31	905	17.2	73	31	899	8.8	66	30	901	13.5	62	24	904	14.0	50	31	902	14.7	54	31	902	17.0	55
1,500	31	850	10.5	59	31	853	14.3	71	31	846	6.3	65	30	849	10.1	63	24	852	10.4	49	31	850	13.5	45	31	851	14.0	58
2,000	31	799	7.7	61	31	804	12.6	61	31	796	3.6	67	30	800	7.3	63	24	802	6.8	49	31	801	10.8	40	31	801	11.4	58
2,500	31	752	5.2	55	31	757	10.6	55	30	748	.9	67	30	752	4.7	61	24	754	3.8	48	31	754	7.7	36	31	754	8.6	55
3,000	31	707	2.1	53	31	713	8.2	44	30	703	−1.9	65	30	707	2.1	58	24	709	.7	44	31	709	4.5	34	31	710	5.5	54
4,000	31	624	−4.3	44	30	631	2.6	37	30	619	−6.9	57	30	624	−3.3	50	24	626	−5.7	40	31	626	−1.4	30	31	627	−.8	48
5,000	31	549	−10.4	37	30	557	−3.3	34	30	544	−12.8	51	30	549	−9.7	47	17	550	−11.9	31	31	552	−7.8	30	31	553	−7.6	42
6,000	31	481	−17.1	34	30	490	−9.7	30	30	477	−19.4	48	30	482	−16.3	45					31	484	−15.0	29	31	485	−14.2	40
7,000	31	420	−24.3	36	30	430	16.9	28	30	416	−26.9	44	30	421	−23.6	43					31	423	−22.6	29	30	425	−21.0	40
8,000	30	366	−32.0	36	29	375	−24.1	27	28	361	−34.7	43	30	367	−31.1	43					31	369	−30.4	29	29	370	−28.5	39
9,000	30	316	−39.8	36	29	326	−31.8	26	25	312	−42.2		30	318	−38.7	43					31	320	−33.4	28	28	321	−36.7	39
10,000	30	273	−47.2		29	283	−39.6		23	269	−48.8		30	274	−45.9						31	276	−46.4		28	277	−44.8	
11,000	30	234	−54.2		29	244	−47.0		22	231	−53.4		30	236	−52.3						31	237	−53.9		28	238	−52.8	
12,000	30	200	−59.4		29	209	−54.3		20	197	−55.4		30	201	−57.1						31	202	−60.3		27	204	−60.2	
13,000	29	170	−61.8		29	178	−59.9		20	169	−54.4		30	172	−59.9						31	172	−63.7		27	173	−64.4	
14,000	27	145	−60.4		29	152	−62.5		18	145	−54.1		30	146	−59.9						30	146	−62.9		24	147	−64.2	
15,000	27	123	−58.7		29	129	−64.7		16	124	−53.5		29	125	−59.4						29	124	−61.6		24	125	−63.6	
16,000	26	105	−58.0		28	109	−66.7		15	106	−54.3		28	106	−59.6						28	106	−61.5		20	106	−63.9	
17,000	25	90	−57.6		26	92	−68.6		13	91	−54.6		27	90	−60.1						28	90	−60.6		16	90	−63.7	
18,000	21	76	−56.8		22	78	−68.4		10	78	−54.7		22	77	−59.7						23	77	−59.5		13	76	−63.1	
19,000	13	65	−55.6		17	66	−65.9		5	66	−53.9		14	66	−58.5						13	65	−58.4		8	65	−61.9	
20,000	7	56	−54.4		6	56	−62.2						5	56	−56.3													

Altitude (meters) M. S. L.	Stations and elevations in meters above sea level																							
	Omaha, Nebr. (301 m.)				Pearl Harbor, T. H.[1] (6 m.)				Pensacola, Fla.[1] (24 m.)				Phoenix, Ariz. (339 m.)				St. Louis, Mo. (171 m.)				San Antonio, Tex. (174 m.)				San Diego, Calif.[1] (19 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	31	979	14.3	63	31	1,015	22.2	84	31	1,014	21.1	73	31	970	24.3	29	31	993	14.6	73	31	994	20.7	76	31	1,011	16.6	84
500	31	956	14.6	58	31	960	20.7	80	31	960	19.5	61	31	952	27.3	24	31	955	15.0	64	31	957	20.7	71	31	955	14.8	79
1,000	31	901	12.5	56	31	906	17.6	81	31	905	17.0	52	31	900	26.4	19	31	900	12.3	64	31	904	19.4	65	31	901	16.0	53
1,500	31	849	9.7	57	31	854	15.1	73	31	854	14.0	49	31	850	22.8	19	31	847	9.0	66	31	852	16.9	62	31	850	16.1	35
2,000	31	799	6.7	58	31	804	12.5	71	31	804	11.0	47	31	802	18.8	20	31	798	6.1	68	31	803	14.2	58	30	801	14.2	31
2,500	31	751	3.8	58	31	758	10.9	55	31	757	8.3	41	31	756	14.7	21	31	750	3.4	66	31	757	11.8	53	30	754	11.3	32
3,000	31	706	0.9	57	31	714	8.9	42	31	712	5.7	39	31	712	10.7	23	31	705	1.2	61	31	713	8.8	51	29	710	8.2	32
4,000	31	623	−4.9	51	30	632	4.1	28	31	630	−0.3	38	30	631	2.7	28	31	622	−4.9	56	31	631	1.9	50	29	628	1.4	34
5,000	31	548	−11.0	45					30	555	−6.2	33	30	557	−4.3	31	30	547	−11.0	53	31	557	−4.7	49	29	554	−5.3	33
6,000	31	480	−17.3	42					27	488	−12.4	27	30	489	−11.2	31	30	480	−17.4	51	31	490	−10.8	46	29	487	−12.2	36
7,000	31	420	−24.3	40					26	427	−19.7	27	30	429	−18.2	30	30	419	−24.7	50	30	429	−17.8	44	28	427	−19.8	46
8,000	31	365	−32.2	39					24	372	−27.6	24	30	375	−26.3	29	30	364	−32.1	48	29	375	−25.3	43	28	372	−27.9	46
9,000	31	316	−40.0						23	323	−35.2	25	30	325	−34.5	29	30	315	−39.6	48	29	326	−32.7	42	28	323	−35.8	
10,000	31	272	−47.1						23	280	−42.7		30	282	−42.7		30	272	−46.6		28	282	−40.9		28	279	−43.6	
11,000	30	233	−53.2						21	241	−50.1		30	242	−50.5		28	233	−52.7		28	243	−48.5		25	239	−51.6	
12,000	30	200	−57.7						17	206	−56.9		30	208	−57.3		27	199	−56.7		28	208	−55.4		25	205	−58.3	
13,000	29	170	−59.1						14	175	−62.5		30	177	−61.7		26	170	−58.7		28	178	−60.8		24	175	−63.0	
14,000	29	145	−57.8						11	149	−63.9		28	150	−62.4		25	145	−59.5		28	151	−62.8		24	149	−63.8	
15,000	28	124	−57.5						10	126	−64.5		27	128	−61.6		25	123	−59.6		27	128	−63.5		24	127	−63.4	
16,000	27	106	−57.4						9	107	−65.3		24	109	−62.2		22	105	−59.9		27	109	−64.9		21	108	−63.4	
17,000	23	90	−57.6						8	90	−65.8		23	93	−62.6		18	90	−60.1		25	93	−66.0		18	92	−63.1	
18,000	21	77	−57.3						7	76	−65.1		19	79	−62.4		15	76	−59.8		22	78	−65.8		13	79	−62.0	
19,000	10	66	−56.7						6	65	−63.9		13	67	−61.2		11	65	−58.2		15	67	−64.1		11	67	−60.9	
20,000																					9	57	−62.1		8	56	−59.8	

See footnotes at end of table.

TABLE 1.—*Mean free-air barometic pressure (P.) in millibars, temperature (T.) in degrees Centigrade, and relative humidities (R. H.) in percent, obtained by airplanes and radiosondes during May 1940*—Continued

Altitude (meters) M. S. L.	Stations and elevations in meters above sea level																							
	S. S. Marie, Mich. (221 m.)				Seattle, Wash.[1] (27 m.)				Shreveport, La. (Barksdale Field) (51 m.)				Spokane, Wash. (598 m.)				Washington, D. C.[1] (7 m.)				Atlantic Station[3] No. 1 (6 m.)				Atlantic Station[4] No. 2 (6 m.)			
	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.	Number of observations	P.	T.	R. H.
Surface	31	986	6.7	85	27	1,014	13.6	73					31	945	13.0	64	31	1,012	13.7	79	29	1,020	17.9	81	27	1,020	15.3	79
500	31	953	7.6	79	27	958	12.8	57									31	954	13.7	67	29	961	13.7	84	27	961	11.6	86
1,000	31	896	6.1	76	27	903	10.9	51					31	901	14.8	51	31	900	11.8	65	29	906	10.8	84	27	906	8.8	85
1,500	31	843	3.4	76	27	850	7.5	55					31	849	11.6	49	31	847	9.3	65	29	854	9.0	76	27	852	7.1	74
2,000	31	792	1.0	76	27	800	4.3	60					31	799	7.7	51	31	797	6.5	64	29	803	7.0	72	27	802	5.5	63
2,500	31	744	−1.6	77	27	751	1.3	59					30	752	3.4	55	31	749	3.9	61	28	756	4.4	71	27	754	3.7	59
3,000	31	699	−4.0	75	27	706	−1.3	53					30	706	−.3	56	31	704	.9	56	28	710	1.7	71	27	709	1.3	53
4,000	29	615	−9.5	69	27	622	−7.2	49					30	623	−6.4	53	31	621	−4.8	47	28	627	−.7	64	77	625	−4.6	49
5,000	29	540	−15.6	62	27	546	−13.2	47					29	547	−13.0	51	31	546	−10.9	42	28	552	−6.4	57	27	550	−10.1	45
6,000	28	472	−22.4	58	27	478	−20.2	57					29	479	−20.0	50	31	478	−17.3	37	27	484	−12.7	54	27	482	−16.3	44
7,000	27	410	−30.2	58	27	417	−27.4	63					29	418	−27.5	50	29	418	−24.6	34	27	423	−19.3	53	27	422	−23.4	46
8,000	25	360	−37.8	58	25	362	−34.9	71					29	363	−35.0	50	23	363	−32.4	34	26	369	−27.0	53	26	367	−31.0	44
9,000	25	311	−44.8	----	23	313	−42.4	----					29	314	−42.6	----	23	314	−40.3	----	24	320	−34.3	52	26	318	−38.6	45
10,000	25	268	−51.2	----	22	270	−49.2	----					28	270	−49.4	----	19	271	−47.8	----	22	277	−41.7	----	26	274	−45.8	----
11,000	25	230	−55.3	----	18	232	−54.8	----					28	232	−55.4	----	16	232	−53.8	----	22	238	−49.7	----	26	235	−53.0	----
12,000	25	197	−56.1	----	15	198	−58.8	----					28	198	−58.6	----	13	199	−57.7	----	21	203	−56.1	----	25	192	−59.5	----
13,000	25	169	−55.3	----	13	169	−59.4	----					28	169	−58.8	----	13	170	−59.8	----	19	173	−60.6	----	25	162	−63.0	----
14,000	24	145	−54.3	----	9	144	−59.2	----					27	144	−57.3	----	12	145	−60.4	----	17	147	−60.3	----	24	129	−62.4	----
15,000	23	124	−54.4	----	7	124	−57.7	----					26	123	−56.3	----	10	124	−60.0	----	17	125	−58.5	----	23	107	−60.8	----
16,000	18	107	−55.0	----	6	106	−56.1	----					26	105	−55.9	----					15	106	−58.5	----	23	89	−59.7	----
17,000	13	91	−55.1	----	6	90	−56.7	----					20	91	−55.3	----					11	90	−57.3	----	19	73	−59.0	----
18,000	9	79	−54.8	----	5	76	−54.0	----					17	77	−55.1	----					7	78	−55.9	----	17	60	−57.9	----
19,000	5	67	−54.1	----									8	65	−54.9	----					5	66	−55.3	----	11	48	−56.3	----
20,000																									7	38	−55.4	----

NOTE.—All observations taken at 1 a. m., 75th meridian time, except those at Washington, D. C., Lakehurst, N. J., Norfolk, Va., and Pensacola, Fla., where they are taken before 5 a. m., 75th meridian time. At Pearl Harbor, T. H., observations are taken after sunrise.

None of the means included in this table are based on less than 15 surface or 5 standard level observations.

Number of observations refers to pressure only as temperature and humidity data are missing for some observations at certain levels; also, the humidity data are not used in daily observations when the temperature is below −40.0° C.

[1] U. S. Navy.
[2] Airplane observations.
[3] Lat. 35°00′ N. to 40°00′ N. Long. 55°00′ W. to 60°00′ W.
[4] Lat. 40°00′ N. to 45°00′ N. Long. 40°00′ W. to 45°00′ W.

TABLE 2.—*Free-air resultant winds based on pilot-balloon observations made near 5 p. m. (75th meridian time) during May 1940*

[Directions given in degrees from North (N=360°, E=90°, S=180°, W=270°)—Velocities in meters per second]

Altitude (meters) m. s. l.	Abilene, Tex. (537 m.)			Albuerque, N. Mex. (1,630 m.)			Atlanta, Ga. (290 m.)			Billings, Mont. (1,095 m.)			Bismarck, N. Dak. (512 m.)			Boise, Idaho (870 m.)			Brownsville, Tex. (7 m.)			Buffalo, N. Y. (220 m.)			Burlington, Vt. (132 m.)			Charleston, S. C. (18 m.)			Chicago, Ill. (192 m.)			Cincinnati, Ohio (157 m.)			Denver, Colo. (1,627 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
		°			°			°			°			°			°			°			°			°			°			°			°			°	
Surface	31	138	2.0	31	233	1.2	31	287	3.2	31	360	1.9	31	355	2.7	31	306	3.9	30	129	5.4	29	215	2.7	31	144	0.5	31	189	3.6	28	322	0.9	29	270	2.9	30	50	1.4
500							31	275	3.7				30	338	1.9				30	134	5.9	29	234	3.4	29	190	1.3	31	214	4.2	28	323	1.5	29	257	4.2			
1,000	31	158	2.9				29	279	6.0				29	312	2.5	31	305	3.8	26	143	4.0	29	243	5.0	29	194	3.0	31	244	4.3	27	296	2.9	25	259	5.1			
1,500	31	189	2.4				28	276	6.3	31	339	1.5	26	306	3.0	31	312	2.7	21	171	2.5	22	239	4.4	27	223	4.9	30	260	5.5	24	273	3.4	25	257	6.9			
2,000	29	224	2.3	31	235	2.3	27	286	7.0	31	292	1.9	25	299	4.9	31	310	1.3	16	221	1.1	18	269	5.7	20	238	5.9	24	273	6.1	21	288	4.9	24	260	8.5	30	47	2.0
2,500	28	253	3.6	31	239	2.1	26	287	7.4	31	287	3.1	24	302	7.6	31	244	1.1	16	259	1.4	16	280	6.9	17	274	5.7	23	274	6.3	15	285	6.6	21	261	8.3	29	42	1.3
3,000	28	284	5.0	29	257	2.7	25	287	8.0	30	284	5.0	14	314	9.6	31	251	2.4	16	287	3.2				11	299	7.4	22	269	7.2				20	273	9.9	28	312	0.7
4,000	25	289	7.8	29	279	4.3	21	289	7.5	27	274	8.5				26	234	4.5	15	294	7.0							20	278	8.1				14	278	12.2	27	288	7.0
5,000	22	295	9.1	26	287	6.3	17	302	10.0	22	276	11.0				20	244	4.6	13	299	10.2							14	286	6.9							24	287	9.4
6,000	17	302	10.4	23	291	4.6	15	299	10.8	17	273	12.5				17	268	7.8																			22	288	10.9
8,000	15	297	10.6	21	273	8.9	13	287	9.9	13	274	14.9																									16	310	12.8
10,000				16	285	9.7	11	279	12.5																												10	300	13.7
12,000				15	279	13.0																																	
14,000				10	272	14.8																																	

TABLE 2.—*Free-air resultant winds based on pilot-balloon observations made near 5 p. m. (75th meridian time) during May 1940*—Continued

Altitude (meters) m. s. l.	El Paso, Tex. (1,196 m.)			Ely, Nev. (1,910 m.)			Grand Junction, Colo. (1,413 m.)			Greensboro, N. C. (271 m.)			Havre, Mont. (766 m.)			Jacksonville, Fla. (14 m.)			Las Vegas, Nev. (570 m.)			Little Rock, Ark. (79 m.)			Medford, Oreg. (410 m.)			Miami, (10 m.)			Minneapolis, Minn. (261 m.)			Mobile, Ala. (10 m.)			Nashville, Tenn. (194 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
		°			°			°			°			°			°			°			°			°			°			°			°		
Surface	31	246	2.4	31	214	2.9	31	307	2.4	27	226	2.5	31	254	1.0	30	135	2.4	31	189	3.3	30	239	1.2	31	315	1.6	30	108	2.6	30	344	2.1	31	196	2.0	30	285	2.3
500										27	225	3.5				30	190	2.1				30	235	1.7	31	308	1.8	30	130	1.7	30	340	2.1	31	245	2.5	30	287	3.3
1,000										27	236	4.9	31	267	1.6	29	243	3.4				29	243	2.6	31	304	2.0	29	250	0.5	30	332	3.3	31	278	2.3	30	275	3.7
1,500	31	249	3.2				31	303	2.5	27	248	5.1	31	258	2.9	28	264	4.7	31	188	3.1	29	265	4.8	31	261	0.9	28	296	2.8	28	295	2.3	31	299	2.9	29	278	5.2
2,000	31	255	2.8	31	211	3.5	31	286	3.0	24	263	5.1	31	254	2.7	25	278	5.2	31	197	3.1	26	281	7.4	31	190	2.0	26	278	4.0	27	298	3.2	30	311	3.7	26	276	6.5
2,500	30	247	3.3	31	209	3.1	31	282	2.9	18	280	7.3	29	255	3.6	23	278	6.4	31	200	4.6	25	283	7.8	31	187	3.9	25	277	4.2	22	304	6.3	27	310	4.7	24	285	7.0
3,000	28	261	3.9	31	205	3.2	31	282	3.0	16	279	8.0	26	265	5.1	26	282	6.9	30	215	4.9	25	291	8.8	29	190	4.7	24	281	5.2	18	314	9.6	26	308	6.1	20	285	8.4
4,000	25	254	5.2	31	227	4.2	31	260	4.9	12	296	9.9	16	270	5.7	26	275	7.1	29	224	5.2	22	299	10.1	28	214	6.1	23	279	6.3				20	285	4.9	17	288	9.3
5,000	18	263	6.7	26	244	6.3	25	272	5.5				14	282	7.1	22	286	7.9	29	240	6.1	15	299	11.7	25	233	5.9	21	282	7.1				18	288	5.9	13	282	9.5
6,000	13	271	7.8	20	245	9.2	21	283	6.4				10	300	6.7	22	282	11.2	28	246	6.2	11	298	12.0	22	241	8.6	20	276	9.4				18	287	8.4			
8,000				16	248	10.6										20	284	11.3	24	259	6.3				17	248	13.5	16	285	11.9									
10,000																20	282	14.7	18	294	5.4				11	273	15.0	11	284	19.5									
12,000																16	277	15.5	15	264	10.6				10	278	18.5												
14,000																14	273	20.8	12	263	11.2																		

Altitude (meters) m. s. l.	New York, N. Y. (15 m.)			Oakland, Calif. (8 m.)			Oklahoma, City, Okla. (402 m.)			Omaha, Nebr. (306 m.)			Phoenix, Ariz. (344 m.)			Rapid City, S. Dak. (982 m.)			St. Louis, Mo. (181 m.)			San Antonio, Tex. (183 m.)			San Diego, Calif. (15 m.)			Sault Ste. Marie, Mich. (230 m.)			Seattle, Wash. (14 m.)			Spokane, Wash. (603 m.)			Washington, D. C. (10 m.)		
	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity	Observations	Direction	Velocity
		°			°			°			°			°			°			°			°			°			°			°			°			°	
Surface	27	64	1.3	29	265	5.2	30	69	0.8	31	340	2.0	31	211	1.4	31	354	3.8	28	291	2.9	31	134	2.4	30	283	4.1	27	300	2.0	30	299	3.2	31	227	2.6	30	187	0.9
500	27	149	1.0	28	267	3.4	30	152	1.5	31	334	3.4	31	200	1.6				28	295	4.9	31	145	3.2	30	294	3.0	27	316	3.0	30	310	1.7				30	242	1.5
1,000	21	260	3.4	28	280	2.1	30	187	1.8	30	343	3.6	31	200	2.2	31	354	3.7	26	288	5.0	31	146	3.5	26	297	2.7	26	291	1.4	30	222	1.8	31	225	2.5	26	261	3.3
1,500	21	275	5.0	27	258	1.6	29	226	1.9	30	333	3.5	31	207	2.5	31	345	4.2	25	281	6.2	30	156	3.1	25	264	1.8	26	231	0.4	28	201	3.1	31	221	3.3	21	266	4.9
2,000	18	269	7.3	26	245	2.1	27	268	3.3	29	308	4.0	31	204	3.0	31	326	4.5	23	284	6.6	29	183	2.4	24	239	3.5	22	318	2.6	26	192	4.6	30	225	4.2	19	269	6.5
2,500	17	279	9.2	26	216	2.3	26	286	5.5	28	303	5.7	31	206	3.0	31	311	4.5	18	309	8.7	27	241	2.0	24	235	3.8	20	300	1.6	24	189	6.2	29	231	4.6	17	274	8.2
3,000				25	219	3.3	21	287	9.5	26	303	7.9	31	221	3.3	29	292	5.9	17	307	9.7	24	270	2.9	24	226	5.1	17	313	4.0	23	198	5.8	24	246	5.1	15	283	9.9
4,000				24	219	5.3	20	298	10.2	20	311	9.9	28	217	3.0	25	302	9.4				21	301	6.4	21	232	6.6	13	305	6.1	20	219	7.5	19	246	9.3	15	286	9.6
5,000				21	229	5.6	18	304	12.2	16	309	13.2	20	246	4.9	21	304	11.4				20	300	8.3	20	238	6.8				18	226	8.4	14	259	9.5	13	280	10.6
6,000				16	274	4.4	14	318	15.5	13	311	17.0	15	255	5.4	16	304	12.7				19	302	10.2	18	253	8.2				12	233	8.7	13	260	10.0			
8,000										10	313	24.0	11	274	6.9	11	307	17.7				13	292	13.2	11	265	9.2											
10,000																						11	290	16.9														

TABLE 3.—*Maximum free-air wind velocities (m. p. s.), for different sections of the United States*

[Based on pilot balloon observations during May 1940]

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station	Maximum velocity	Direction	Altitude (m.) m. s. l.	Date	Station
Northeast [1] *	41.0	WNW	2,440	7	New York	42.7	SW	2,870	19	Columbus	44.0	W	6,760	9	Boston.
East-Central [2]	32.0	SW	1,290	15	Knoxville	34.2	SW	3,200	2	Richmond	35.0	NNW	7,160	5	Greensboro.
Southeast [3]	31.0	NW	1,890	4	Tampa	38.8	NNW	2,980	3	Mobile	50.4	NW	12,500	21	Miami.
North-Central [4]	40.4	WNW	2,120	6	Sault Ste. Marie	40.8	NNW	3,240	2	Minneapolis	59.6	NNW	7,300	1	Huron.
Central [5]	35.8	SW	1,100	13	Des Moines	41.0	WSW	4,000	7	Omaha	57.5	NNW	{8,040 {8,320	} 2	Omaha.
South-Central [6]	41.2	NNW	2,470	1	Oklahoma City	36.8	NW	4,020	1	Dallas	47.8	WNW	7,290	11	Brownsville.
Northwest [7]	41.3	W	1,972	6	Pocatello	46.6	W	2,890	4	Pocatello	55.0	WNW	10,940	12	Medford.
West-Central [8]	26.2	S	1,710	4	Salt Lake City	54.4	SW	4,120	2	Winnemucca	62.0	WSW	8,620	3	Winnemucca.
Southwest [9]	30.9	WNW	2,280	17	Roswell	27.3	W	2,730	13	El Paso	48.0	WSW	16,915	28	Albuquerque.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

* Data for Buffalo, Elmira, and Atlanta not included in this table.

244521—40——2

TABLE 4.—*Tropopause summary, May 1940*—Continued

Stations	Albuquerque, N. Mex.			Atlanta, Ga.			Billings, Mont.			Bismarck, N. Dak.			Boise, Idaho			Buffalo, N. Y.			Charleston, S. C.		
Potential temperatures ° A.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.
290–299																					
300–309							2	6.8	35.0	1	7.0	37.0				2	8.4	49.0			
310–319				5	8.8	46.4	1	9.1	50.0	9	8.8	46.9	2	8.4	41.0	7	8.9	48.1	1	9.1	48.0
320–329	5	10.1	48.4	8	10.2	50.1	15	10.6	55.1	20	10.5	55.0	24	9.9	49.6	23	10.0	51.1	11	9.8	46.5
330–339	26	11.4	55.5	12	11.3	55.6	21	11.6	60.1	22	11.6	60.0	29	11.8	60.2	29	11.6	59.8	17	11.4	55.0
340–349	20	12.8	63.2	20	12.7	61.8	15	12.7	63.4	5	12.1	59.4	16	12.7	63.8	11	12.4	61.2	21	12.7	62.0
350–359	8	13.6	64.9	13	13.4	63.4	3	13.4	65.3	1	13.5	66.0	6	13.6	64.8	3	13.0	60.7	10	13.5	64.4
360–369	1	14.4	65.0	1	13.4	59.0				1	13.7	60.0	1	14.1	65.0				2	14.2	64.0
370–379	1	15.8	69.0							1	13.7	55.0	1	14.3	60.0	2	13.4	53.5	2	14.6	63.0
380–389	2	15.2	63.0	2	15.6	67.0				2	14.0	55.0				2	14.0	57.5	2	15.3	65.5
390–399	4	16.0	64.2	4	15.5	61.0	2	15.1	58.5				1	15.3	61.0	2	15.2	59.5	4	15.6	61.5
400–409	5	16.4	64.0	6	16.3	65.2	2	15.8	59.0	2	15.6	56.5	4	15.8	58.8	2	15.6	60.0	3	16.5	63.7
Weighted means		12.8	59.8		12.6	59.0		11.8	58.9		11.2	56.0		11.8	57.7		11.3	56.1		12.5	58.4
Mean potential temperature ° A (weighted)		349.5			349.4			337.5			333.9			340.2			336.7			347.9	
Number days with observations		28			28			27			25			30			29			28	

Stations	Denver, Colo.			El Paso, Tex.			Ely, Nev.			Fairbanks, Alaska			Joliet, Ill.			Juneau, Alaska			Lakehurst, N. J.		
Potential temperatures ° A.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.
290–299										3	7.0	45.3				2	7.0	44.5			
300–309										18	8.0	47.8				12	8.1	49.6			
310–319	1	7.8	33.0				1	8.0	33.0	25	9.1	52.0	8	8.9	48.1	22	9.3	53.5	6	9.0	50.0
320–329	8	10.6	52.8	3	9.7	43.0	11	10.5	52.7	11	10.4	57.3	15	9.9	49.5	9	10.2	56.4	14	10.0	49.5
330–339	16	11.8	58.9	16	11.6	55.9	24	11.8	59.6				15	11.4	58.5	4	10.9	57.0	19	11.2	56.2
340–349	22	12.8	64.0	25	12.8	61.8	15	13.1	65.3				8	12.0	58.8				6	12.3	60.5
350–359	2	13.6	66.5	15	13.6	63.5	3	13.8	66.3				1	13.6	68.0	1	12.0	53.0	5	13.2	62.8
360–369	3	14.5	66.7	2	14.6	65.5							1	13.1	59.0						
370–379				1	14.5	63.0	1	14.1	60.0				1	14.6	64.0						
380–389				1	15.5	65.0	3	15.2	61.7				3	13.9	54.3				1	14.5	58.0
390–399	2	15.4	59.0	4	15.9	66.2	1	15.2	59.0	1	13.8	47.0	1	15.0	56.0				1	14.4	55.0
400–400	4	16.0	60.8	4	16.5	66.0	1	16.5	67.0	1	14.3	46.0	1	15.7	60.0	1	14.4	52.0	1	15.1	56.0
Weighted means		12.6	60.4		13.1	60.7		12.2	59.9		9.1	51.2		11.1	54.5		9.4	53.0		11.1	54.8
Mean potential temperature °A. (weighted)		345.8			351.6			341.3			315.7			336.6			317.0			335.3	
Number of days with observations		25			28			24			27			25			22			27	

Stations	Medford, Oreg.			Miami, Fla.			Minneapolis, Minn.			Nashville, Tenn.			Oakland, Calif.			Oklahoma City, Okla.			Omaha, Nebr.		
Potential temperatures ° A.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature ° C.
290–299																					
300–309	1	8.5	51.1																		
310–319	2	9.3	51.0				5	8.8	46.4	2	7.4	33.5	1	7.7	32.0				6	8.7	46.2
320–329	13	10.1	51.1				12	10.0	50.9	9	9.7	47.3	10	10.2	51.1	8	10.1	48.5	11	10.2	50.7
330–339	27	11.7	59.8	13	10.5	45.1	16	11.3	62.0	18	11.4	56.8	27	11.9	60.6	24	11.9	59.7	26	11.7	59.0
340–349	14	12.8	64.9	26	12.4	57.5	3	12.3	61.0	19	12.6	61.2	23	12.9	65.7	25	13.0	65.5	15	12.4	61.5
350–359	7	13.5	66.0	20	13.4	62.1				8	13.4	63.0	2	13.1	60.5	6	13.7	66.3	2	13.7	66.5
360–369				3	14.7	68.0							3	13.3	59.3				2	13.0	54.5
370–379	1	14.3	62.0	9	15.1	67.1				2	14.0	58.0									
380–389	1	14.8	59.0	8	15.9	67.9	2	14.2	55.0	1	14.3	56.0	1	14.7	62.0	3	15.3	63.7	1	15.1	62.0
390–399	1	14.5	56.0	1	16.3	67.0	1	14.6	56.0	1	15.9	65.0	6	15.7	62.8	6	15.8	65.0	3	15.1	58.3
400–409	1	15.2	56.0	8	17.1	69.2	2	15.4	56.0	1	15.7	60.0	3	16.1	61.3	1	15.8	63.0	2	15.6	58.0
Weighted means		11.9	59.3		13.5	60.2		11.1	56.0		11.9	57.0		12.5	60.7		12.7	61.6		11.8	57.1
Mean potential temperature °A. (weighted)		338.5			358.6			336.8			342.4			345.8			346.3			340.1	
Number days with observations		30			29			20			30			31			27			30	

TABLE 4.—*Tropopause summary, May 1940*—Continued

Stations	Phoenix, Ariz.			St. Louis, Mo.			San Antonio, Tex.			San Diego, Calif.			Sault Ste. Marie, Mich.			Seattle, Wash.			Spokane, Wash.		
Potential temperatures °A.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.
290–299													1	6.7	43.0						
300–309													5	7.9	49.4				4	7.9	45.5
310–319													6	8.8	46.3	5	9.2	53.0	6	9.2	53.2
320–329	6	9.9	45.7	19	9.7	47.7	4	11.0	53.0	3	11.2	56.3	22	10.1	52.9	8	10.7	56.2	22	10.3	51.6
330–339	20	11.3	53.0	23	11.4	56.9	11	10.9	49.0	16	11.5	56.4	17	11.5	53.7	3	11.3	55.3	20	11.6	50.2
340–349	25	12.8	62.3	16	12.7	62.8	26	12.4	58.0	13	12.8	62.9	4	11.8	57.0	5	12.8	63.8	12	12.6	62.4
350–359	9	13.7	63.8	1	13.1	61.0	19	13.7	64.1	5	13.8	65.6									
360–369	1	14.7	68.0	1	13.3	56.0	4	14.2	65.2	1	14.4	67.0	1	12.8	54.0				1	14.1	66.0
370–379	3	14.5	62.3	2	13.9	55.5	1	14.8	67.0												
380–389	1	15.9	70.0	1	14.6	60.0	2	15.8	64.5				1	14.4	57.0				1	14.2	54.0
390–399	3	16.3	67.0	4	15.0	56.2	7	16.3	66.9	1	15.3	60.0							2	14.9	55.5
400–409	1	16.6	63.0	4	15.9	60.0	5	16.8	68.6	3	16.6	66.7	1	15.6	58.0				2	15.8	57.5
Weighted means		12.6	58.8		11.4	53.5		13.2	59.8		12.7	60.6		10.5	54.2		10.9	57.1		11.2	56.0
Mean potential temperature °A (weighted)	346.5			340.3			354.4			343.4			328.4			328.4			334.8		
Number days with observation	29			29			28			24			25			16			28		

Stations	Atlantic Sta. 1 (lat. 36, long. 53)			Atlantic Sta. 2 (lat. 42, long. 38)		
Potential temperatures, °A.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.
290–299						
300–309				1	8.1	48.0
310–319				3	8.6	44.7
320–329	10	10.7	54.0	12	10.2	51.2
330–339	11	11.9	61.6	23	11.7	58.7
340–349	18	12.9	65.1	19	12.9	63.4
350–359	8	13.6	66.1	4	13.9	67.0
360–369	1	14.7	71.0	4	14.3	67.0
370–379						
380–389				2	14.9	60.5
390–399	1	15.8	65.0	2	15.7	62.5
400–409	2	16.0	63.0			
Weighted means		12.6	62.4		12.0	59.0
Mean potential temperature °A. (weighted)	343.5			340.9		
Number days with observations	20			27		

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in Charge]

By BENNETT SWENSON

Except for floods in the Ohio Valley that continued from April, only a few minor to moderate floods occurred during May 1940. The month was generally deficient in precipitation, except in the northeast, the Great Lakes region, Kansas, and New Mexico.

Atlantic Slope Drainage.—The following report on a flood in the Merrimack River Basin is submitted by the Concord, N. H., office:

A moderate rise in stages on the Pemigewasset and Merrimack Rivers occurred on May 3 to 6. Flood stages were reached in the headwater reach of the Pemigewasset near Lincoln, and thence down-stream to Manchester.

The Pemigewasset was the only tributary which contributed to the high flow. The Contoocook rose less than one foot. Crest stages at Plymouth, Franklin, Concord, and Manchester were the highest reached since the September 1938 flood.

Stages had been moderately high since the rise in mid-April. Snow in the Pemigewasset valley began to melt rapidly on April 29, due to unseasonably high temperatures. The resulting run-off gradually filled the channels to within a few feet of flood stage. Rain, attended by high temperatures began on the early morning of May 2, and continued intermittently until the early morning of May 5. The accelerated rate of snow melt, combined with the rainfall of this period resulted in a minor flood.

Moderate flooding occurred in the Connecticut River from May 2 to 10 as the result of the following conditions:

Several days of temperatures in the seventies during the last week of April caused a rapid melting of the snow which remained in the upper reaches of the basin. The resulting run-off increased the flow at South Newbury, Vt., from approximately 10,000 cubic feet per second on April 25 to 46,000 on May 5. To this run-off was added that from rains during the period May 2–5, the combined flow producing stages above the flood level quite generally.

East Gulf of Mexico Drainage.—Moderate to heavy rainfall over Mississippi and Alabama between April 29 and May 1, produced moderate flooding in the Tombigbee, Pearl, and Pascagoula Basins during the first part of May. In the Tombigbee River the flooding was confined mainly to the lower portion; no damage of consequence was reported.

An interesting feature of the flood in the Pascagoula River was the distribution of rainfall on April 30 and the resulting rapid rises in the Chickasawhay River by May 1. The 7-inch rainfall area seems to have covered narrow por-

tions of Clarke, Jasper, Smith, and Rankin Counties, with 24-hour amounts of rainfall ranging from 5 to 7 inches at numerous stations in this area. On May 1, the 24-hour rises in river stage were as follows: Shubuta, Miss., 24.3 feet; Enterprise, Miss., 14.8 feet; and Waynesboro., Miss., 18.2 feet.

The total damage in the Pearl and Pascagoula Basins has been estimated at about $15,000. Agricultural land to the extent of 1,200 acres was inundated.

Ohio Basin.—Moderately heavy floods occurred over the greater portion of the Ohio Basin, beginning at the close of March in the upper portion and continuing into the first week of May in the lower portion. Rainfall over the Allegheny and Monongahela Basins beginning March 27, plus the melting of snow on the ground, resulted in rises in these streams and a crest stage of 28.5 feet was reached at Pittsburgh on March 31. Flood stages were exceeded in the Ohio River from this rise only as far downstream as immediately below Wheeling, W. Va.

Frequent rains during April over much of the Ohio Basin resulted in a series of rises, culminating with generally heavy rains from April 17 to 20 with the result that flood stages were exceeded along the entire Ohio Valley.

On the morning of April 17, a low was centered over Oklahoma with a warm front extending nearly in an easterly direction from the center of the low. Warm-front rains were occurring quite generally over the Ohio Basin. The disturbance moved northeastward and on the morning of the 18th the center was located over Lake Huron. A cold front extended from this point south—southwestward to Louisiana where a wave was developing. The wave continued to develop, moved slowly northward, and on the 19th it was centered between Memphis and Nashville, Tenn., as a fully developed disturbance. A warm front lay parallel and just to the south of the Ohio River with general rains again spreading over most of the Ohio Valley.

This disturbance moved slowly east-northeastward, and on the early morning of the 21st was centered off the coast in the vicinity of Atlantic City. Rain continued over the Ohio Basin after the passage of the center as cyclonic winds overrode the cold dome of air to the rear of the disturbance. Rain ceased after the early morning of the 21st.

The floods in the Ohio Valley from March to May generally were not severe but there was considerable overflow with resulting damage to crops and farm lands and inconvenience and delay of business. The total damage throughout the Valley has been estimated at more than $600,000.

The reports by various river district offices along the Ohio River follow:

Report on flood in the Pittsburgh river district March 31 to April 7.—A rainy period set in during the night of March 27 and on the morning of March 28 precipitation was reported in amounts ranging from traces over the upper Monongahela Basin to over 1 inch in the middle Allegheny. Some of the precipitation was in the form of snow over the higher elevations. On March 29 the rivers showed small rises, 1 to 2 feet, with additional amounts of precipitation of less than 0.10 inch.

On the morning of March 30 precipitation ranging from traces over the headwaters of the Monongahela and Allegheny Rivers to 0.70 inch over the lower reaches was reported. Additional amounts of precipitation up to one-half inch were reported at 1 P. M. of the same day, and the 7 P. M. reports indicated a total rainfall for the storm of from one half-inch over the upper Allegheny Basin to 2.25 inches over the Central Basins, and 1.50 inches over the upper Monongahela. About 3 inches of water in the form of snow on the ground was present in the upper Allegheny Basin of which 2 inches was expected to melt on March 30 and 31.

The actual crest stage reached at Pittsburgh was 28.5 feet on March 31. The crest stages in the Allegheny and Monongahela Rivers were only slightly above the flood stages, and as a result the damage was slight. In the Allegheny River the water covered the lock walls, but at this season there is little navigation on that river; therefore, there was little loss due to suspension of navigation.

Report on flood in the Pittsburgh District April 4 to 10.—The Allegheny River was running almost bankful during the first week in April, due to melting snow in southern New York and in the mountains of western Pennsylvania at the head of the river and to the rains of the last week in March, which caused the flood of March 31 and April 1 previously reported. Additional rain on April 4 and again on the 9th raised the already swollen streams to flood stages or slightly above again on the 9th and 10th of April.

No damage resulted from this flood due to the fact that damage stages were not reached.

Report on flood in the Pittsburgh District April 20 to 23.—The rivers throughout the district were at high stages, and in some sections nearly bankful during most of the month of April, due to the frequent rains which kept the ground saturated and the run-off heavy. On the morning of the 20th the 24-hour amounts of rainfall averaged about 1.50 inches over the Allegheny River from Franklin down, nearly 1 inch over the Monongahela and nearly 2 inches over the Ohio River from Pittsburgh to Wheeling, W. Va. This heavy rainfall started a rapid rise in all the rivers, but flood stages were not reached except in the lower Allegheny and in the Ohio.

Flood stage was reached at Pittsburgh about 7:45 A. M. and the crest stage of 28.28 feet at 12:30 A. M. of the 21st. At Wheeling a crest of 42.6 feet was reached at 3 P. M. of the 21st.

Due to the timely warnings little damage resulted in the Pittsburgh district. All damageable property that could be moved was carried to a place of safety in ample time. As a result of the protracted wet weather little plowing had been done, the result of which was little loss by erosion. The principal money loss was the cost of cleaning up highways, basements, etc., after the water receded.

Report on flood in the Parkersburg River district.—Heavy rains over the upper Ohio Basin during the closing days of March caused rapid rises in this district, except in the Muskingum and Hocking Basins, during the first 2 days of April. However, flood stage was reached in the Ohio River only at Dam No. 14 where the crest on April 2 was 2 feet above flood stage. Other Ohio River stations downstream had crests ranging from 7 to 8 feet below their flood stages.

The Ohio River receded slowly and stages were above 20 feet at all stations when moderate rains set in on the 16th and continued until the 19 when heavy to excessive rains fell. The amounts were particularly heavy over the Hocking, the Muskingum and the immediate Ohio Valleys. Averages by basins were:

Basin	Apr. 16-18	Apr. 19-20
Ohio (New Cumberland to Point Pleasant)	1. 23	2. 13
Little Kanawha	1. 39	1. 75
Hocking	1. 56	2. 78
Muskingum (at and below Zanesville) and Licking	1. 32	2. 78
Great Kanawha (Kanawha Falls to Pt. Pleasant)	. 75	1. 61

The smaller tributaries started to rise on the 16th and all rivers were rising, the main river slowly, on the 17th. Late on the 18th the rise became rapid throughout the district. Flood stages were reached on the Hocking and on the lower Little Kanawha on the 19th and the Muskingum and at all but two of the Ohio River stations on the 20th. The Muskingum at Zanesville and the lower Little Kanawha at Creston crested on the 20th, the Hocking, the central Muskingum and Dam No. 14, Ohio River, on the 21st, and the Ohio from below Dam 14 to Point Pleasant on the 22nd, except at Pomeroy where the crest was reached shortly after midnight of the 22nd. The recession was slow; the time that the river was above flood stage ranging from about 75 hours at the upper limit of the district to about 130 hours at the lower limit. The crests were the highest of record for so late in the season at Marietta and Parkersburg. At Point Pleasant the crest was the second highest of record for so late in the season. Due to the impounding of water by the dams in the Muskingum Conservancy District, crests in the Muskingum River and in the Ohio River at and below Marietta were below those normally expected from the amount of rain that had fallen.

No severe losses were reported, due to timely warnings and efficient methods of evacuation. However, inconvenience of moving was considerable, but was deemed more of a nuisance than otherwise. About 700 homes in the district were evacuated. Most of the business districts in Point Pleasant and Marietta were under water. Pomeroy had three feet of water on Main Street, and about eight blocks of the wholesale-warehouse section of Parkersburg were under several feet of water.

Report on flood in the Cincinnati river district.—Heavy rains during the latter part of March 1940 resulted in flood conditions in the extreme upper Ohio Basin and threatened conditions in the river

below. These flood waters resulted in a crest of 42.8 feet at Cincinnati on April 5. Rainfall over the valley on April 7, 8, and 11 was sufficient to prevent a rapid fall in river stages, so that by the morning of April 17 the river was still moderately high at a stage of 34.9 feet. Heavy rains fell over the district between April 18 and 20, the fall being more than 5 inches in southwestern Ohio. All of the tributaries began to rise during April 19, the rise being especially rapid in the Licking and the two Miamis, although, except at the mouth, flood stages were reached only in the Little Miami with a crest of 26.77 feet at Kings Mills, Ohio, at 1 A. M. on April 20.

On the morning of April 20 flood warnings were issued for the district along the Ohio River, with tentative crests ranging from 52 feet in the upper portion to 59 feet at Cincinnati indicated within the following four or five days. Crest stages above Cincinnati were revised somewhat during the next few days, but no change was made for Cincinnati until the morning of April 22 when the crest was raised 1 foot to 60 feet with no change in the time of occurrence. Actual crests were close to the final crest forecasts at all places in the district.

The effects of the heavier rains in southwestern Ohio caused a rather complex river situation, as shown in the abnormal stage relation between Portsmouth, Ohio, and Cincinnati. On the morning of April 20 the stage at Cincinnati (50.5 feet) was eight feet higher than Portsmouth; by the morning of the 21st Cincinnati was only 4.3 feet higher than Portsmouth, and on the morning of the 22d the Portsmouth stage was 56.6 feet, 0.8 of a foot higher than Cincinnati. This was due to the local tributaries having run out while Portsmouth was feeling the effects of the floodwaters from above.

The hourly river stages at Cincinnati, Ohio, are given in following table:

Hourly river stages (flood stage 52) Apr. 19 to Apr. 28, 1940, at Cincinnati, Ohio

[Elevation of gage zero 428.8 feet above m. s. l.]

Date	A. M.												P. M.											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
19							39.4	39.7	40.0	40.0	41.0	41.6	42.2	42.7	43.1	43.6	43.8	44.4	44.8	45.4	46.0	46.6	47.3	47.8
20	48.3	48.8	49.2	49.6	49.9	50.2	50.5	50.7	51.2	51.4	51.6	51.8	52.0	52.2	52.4	52.6	52.8	52.9	53.1	53.3	53.4	53.6	53.8	53.9
21	54.1	54.2	54.3	54.3	54.4	54.4	54.5	54.6	54.6	54.7	54.8	54.8	54.8	54.8	54.8	54.9	54.9	54.9	55.0	55.0	55.1	55.1	55.2	55.2
22	55.3	55.4	55.4	55.5	55.6	55.7	55.8	55.8	55.9	56.0	56.1	56.2	56.4	56.5	56.6	56.6	56.7	56.8	56.9	57.0	57.1	57.1	57.2	57.3
23	57.4	57.5	57.6	57.7	57.8	57.9	58.0	58.0	58.1	58.2	58.3	58.4	58.4	58.5	58.6	58.7	58.8	58.9	59.0	59.0	59.1	59.2	59.2	59.2
24	59.4	59.4	59.5	59.6	59.6	59.6	59.6	59.7	59.8	59.8	59.8	59.8	59.9	59.9	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
25	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	59.9	59.9	59.9	59.8	59.8	59.8	59.8	59.7	59.7	59.6	59.6	59.5	59.5	59.4
26	59.4	59.3	59.2	59.2	59.1	59.0	59.0	58.9	58.8	58.7	58.7	58.6	58.5	58.4	58.3	58.2	58.0	57.9	57.9	57.8	57.6	57.5	57.4	57.3
27	57.2	57.1	57.0	56.9	56.7	56.6	56.5	56.4	56.2	56.1	55.9	55.8	55.7	55.5	55.4	55.2	55.0	54.9	54.8	54.6	54.4	54.2	54.1	53.9
28	53.7	53.5	53.3	53.1	52.9	52.7	52.6	52.4	52.1	52.0	51.7	51.6	51.3	51.1	50.9	50.7	50.4	50.2	50.0	49.8	49.5	49.3	49.1	48.9

N. B.—Crest stage 60.04 from 10 p. m. Apr. 24th to 6 a. m. Apr. 25th.

Report on flood in the Louisville river district.—Heavy rains that fell rather generally in the immediate Ohio Valley, and especially affecting the tributaries in the State of Ohio, in the period April 17–20, caused a rapid rise in the Ohio River that brought flood stages to this district by the morning of April 21.

Warnings were issued on April 20 stating that flood stages were expected within the next 24 to 36 hours. Tentative crests were given in the bulletin of Sunday, April 21. On the 22d crests were estimated as follows: Madison, Ind., 51 feet; Louisville, 35 feet upper and 62 feet lower gage; Dam No. 45, 54 feet. Due to a shower area that passed over the section on the 23d, crests in some instances were raised 0.5 foot. No appreciable run-off resulted from these showers.

The crests reached were as follows: Madison, 50.8 feet on the 25th; Louisville, 35 feet upper, 61.9 feet lower gage on the 26th; Dam No. 43, 62.9 feet on the 26th; Dam No. 44, 62.1 feet on the 26th; Dam No. 45, 53.6 feet on the 26–27th.

Roads along the river were flooded at some low places. In quite a few instances families living at low levels in New Albany, Louisville, and Jeffersonville, were forced to move. Most of the damage was the result of flooding of crops that were growing on low ground. Delay in preparing bottom lands for planting also resulted from the flood.

Report on flood in the Indianapolis, Ind., river district.—The flood period was caused by the rain reported from April 16 to 20 inclusive. These rains were not of uniform intensity over the entire basin, and in fact, were comparatively light in the upper Wabash Valley, and of only moderate intensity in the middle Wabash and upper West Fork of the White. Excessively heavy rains occurred in the lower White Valley and over the East Fork, particularly on the last day of the 4-day period of rainfall.

Advices and forecasts were issued in advance of the flood throughout the lower Wabash and the lower West Fork of White and the entire East Fork and Main White stretches.

However, the conditions of soil, state of vegetation, and irregular distribution of the rain, together with the lack of reports received daily, did not result in an altogether accurate picture of the actual distribution of rainfall. In the lower part of the West Fork, and in the upper part of the East Fork of the White, crest stages were reached very shortly after the cessation of excessive rains and at these places the estimated crests to follow were somewhat in excess of those actually occurring. This affected in a similar manner the expected stages for crests in the Main White and the Lower Wabash, which were also somewhat under those originally predicted.

On the other hand, the amount of savings in the worst affected sections were considerable in amount, and it is believed that the advices were, in practically all cases, greatly appreciated. The amount of damage and savings were heaviest in the East Fork White River Valley, where the accumulated rainfall was much greater than in other stretches.

Report on flood in the Evansville, Ind., river district.—The April–May 1940 flood started with a rain period during the last few days of March. Rains at this time were generally of a moderate character. As a result of these general rains the Ohio River began a moderate rapid rise by the 2d of April in this district. The Green and Barren Rivers rose rapidly passing flood stages by a few tenths of a foot. Flood warning was issued for Woodbury on April 1 to crest near 34 feet, flood stage, on the 2d. River came to a stand at 7 a. m. on the morning of the 3d at 34.3 feet. No warnings were issued for either Munfordville or Bowling Green as flood stages were not expected because of the moderate amounts of precipitation reported from the river station Observers. Greater amounts of rainfall were recorded at rainfall stations in upper regions, reports of which were not available at the time of the forecast.

A second period of light to moderate and locally heavy rains in southern sections occurred on the 5th, 6th, and 7th of April. This was just during the period when the Ohio River was cresting, all below flood stages, from the first rain. These rains had little effect on the stages.

On April 11 and 12 precipitation was generally moderate throughout the valley, giving a rise of a few tenths of a foot in the district at the time when stages were already high. The effect was to retard the slowly falling stages.

Beginning on the 17th and continuing for a period of 4 days precipitation was heavy throughout the valley. Forecasts were first issued on the 19th.

Flood stages did not materialize as anticipated in the upper region of the Green River and all of the Barren River. Neither did the stage at Woodbury, Ky., rise as high as expected. The only way it can be accounted for is that the rain period spread out over several days with only moderate amounts daily, although total rainfall averaged more than an inch over that of the period in the latter part of March which carried higher stages. Then, too, precipitation was not so heavy in the source regions which was not known at the time.

This was a major flood. Only nine previous times did the high water exceed the present one and one other time it was equaled in the 48 years that records have been maintained. Loss was mostly to unprotectable property. Due to lateness in the season loss was great to the grasses and grains, killing the major part in its path. Principal loss resulted from suspension of farm operations at a time when a great deal of work should have been in progress. Considerable farming implements were moved out of the lowlands. It is estimated that 100 to 175 families left their homes.

Arkansas Basin.—The following account of a heavy rainstorm in the vicinity of Wichita, Kans., was submitted by the official in charge at that place:

On the early morning of the 8th a very heavy rainstorm passed to the north of the city of Wichita sending a great volume of water

into the city through the small creeks in north Wichita. A bridge on the Chisolm Creek, which runs through north Wichita, was washed away at a cost to the city of $4,000. There was more water in the drainage canal and in the north part of Wichita during the early morning hours than had been seen in the city since 1925.

Red Basin.—Slight overflows were recorded in the Little and Sulphur Rivers in Texas during the month; very little damage occurred. In the Sulphur River, Ringo Crossing, Tex., reported crest stages of 22.5 feet on May 10; 23.1 feet on May 22; 24.0 feet on May 29. Naples, Tex., reported 24.8 feet on May 4–5 and 26.2 feet on June 2.

West Gulf of Mexico drainage.—The upper portion of the Trinity River experienced two principal rises to above flood stage. Heavy rains on the early morning of the 18th resulted in a crest stage slightly below flood stage at Dallas, Tex., but exceeding flood stage at Trinidad, Tex., on May 22 by 3.7 feet. Moderately heavy rains again on the 22d, and on the 28th in the extreme upper portion, produced the second rise approximately reacing flood stage at Dallas on the 30th and Trinidad on the 27th. Damages were slight.

Pacific slope drainage.—Kings River at Piedra, Calif., reached and passed flood stage slightly on May 11, 15, 16, and 25. These stages were fully anticipated and no areas were endangered, as maximum diversions for irrigation were being made, except for the discharge entering Tulare Lake Basin.

Table of flood losses during May 1940

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable farm property	Suspension of business	Total
Atlantic slope drainage:						
Connecticut River			$50,000		$12,500	$62,500
James River	[1] $400				25	425
East Gulf of Mexico drainage:						
Pearl and Pascagoula Rivers	10,968		500	225	3,250	14,943
Mississippi system:						
Ohio Basin:[2]						
Allegheny	1,000					1,000
Monongahela	700					700
Scioto	26,000		16,500			42,500
White in Indiana	28,100	38,000	110,200	1,000	22,350	199,650
Wabash	15,500	450	15,000		2,600	33,550
Green in Kentucky	1,350		17,800		15,000	34,150
Ohio River	63,600	500	115,075	6,800	139,950	325,925
Arkansas Basin: Chisolm Creek in Wichita, Kans	4,000					4,000
Red Basin: Sulphur River			500			500
West Gulf of Mexico drainage:						
Trinity River			2,500			2,500

[1] Roads and crops. [2] Floods March–May.

FLOOD-STAGE REPORT FOR MAY 1940

[All dates in May unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
	Feet			*Feet*	
Pemigewasset: Plymouth, N. H.	11	2	4	15.1	3.
Merrimack:					
Franklin, N. H.	14	2	6	19.6	3.
Concord, N. H.	12	3	6	14.6	4.
Manchester, N. H.	7	4	6	7.8	5.
Connecticut:					
South Newbury, Vt.	22	3	7	29.3	5.
White River Junction, Vt.	18	2	7	22.2	5.
Walpole, N. H.	30	3	6	34.3	5.
Montague City, Mass.	28	2	8	34.9	5.
Holyoke, Mass.	9	3	6	10.9	5–6.
Hartford, Conn.	16	1	10	23.6	6.
Neuse: Neuse, N. C.	14	26	27	14.5	27.
EAST GULF OF MEXICO DRAINAGE					
Leaf: Hattiesburg, Miss.	18	3	5	13.7	4.
Chickasawhay:					
Enterprise, Miss.	20	2	4	22.6	3.
Shubuta, Miss.	26	Apr. 30	7	32.8	1.

FLOOD-STAGE REPORT FOR MAY 1940—Continued

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
EAST GULF OF MEXICO DRAINAGE—continued					
	Feet			*Feet*	
Pascagoula: Merrill, Miss.	22	5	10	23.6	8.
Pearl:					
Jackson, Miss.	18	Apr. 30	13	25.45	8.
Monticello, Miss.	15	1	8	22.2	3.
Columbia, Miss.	17	3	9	20.8	5–6.
Pearl River, La.	12	[1]	19	15.0	11.
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Mississippi: Louisiana, Mo.	12	27	27	12.0	27.
Missouri Basin					
Grand: Chillicothe, Mo.	18	9	9	18.7	9.
Ohio Basin					
Allegheny:					
Red House, N. Y.	10	Mar. 31	Apr. 11	12.0	Apr. 5.
		Apr. 12	Apr. 13	10.0	Apr. 13.
Warren, Pa.	12	Apr. 4	Apr. 6	13.0	Apr. 5.
Franklin, Pa.	17	Apr. 4	Apr. 4	17.0	Apr. 4.
Lock No. 8, near Mosgrove, Pa.	24	Mar. 31	Apr. 7	27.3	Apr. 1, 4.
		Apr. 9	Apr. 10	24.3	Apr. 9.
		Apr. 21	Apr. 21	24.1	Apr. 21.
Lock No. 5, Schenley, Pa.	24	Mar. 31	Apr. 7	31.8	Mar. 31.
		Apr. 9	Apr. 10	25.1	Apr. 9.
		Apr. 20	Apr. 22	27.6	Apr. 21.
Lock No. 4, Natrona, Pa.	24	Mar. 31	Apr. 6	29.7	Mar. 31.
		Apr. 20	Apr. 22	25.8	Apr. 1
Lock No. 3, Acmetonia, Pa.	25	Mar. 31	Apr. 2	29.9	Mar. 31.
		Apr. 4	Apr. 6	27.1	Apr. 4.
		Apr. 20	Apr. 21	26.5	Apr. 20.
West Fork of Monongahela: Clarksburg, W. Va.	5	Mar. 31	Mar. 31	6.0	Mar. 31.
		Apr. 19	Apr. 21	5.5	Apr. 20.
		31	31	5.8	31.
Tygart: Dailey, W. Va.	9	24	24	9.3	24.
Youghiogheny: Connellsville, Pa.	13	Mar. 31	Mar. 31	13.2	Mar. 31.
Muskingum:					
Lock No. 10, Zanesville, Ohio	25	Apr. 20	Apr. 21	27.3	Apr. 20.
Lock No. 3, Lowell, Ohio	25	Apr. 20	Apr. 22	30.0	Apr. 21.
Little Kanawha: Creston, W. Va.	20	Apr. 20	Apr. 20	21.45	Apr. 20.
Hocking: Athens, Ohio	17	Apr. 19	Apr. 23	22.75	Apr. 21.
Little Sandy: Grayson, Ky.	15	Mar. 31	Apr. 1	18.5	Mar. 31.
		Apr. 20	Apr. 21	18.1	Apr. 20.
Scioto:					
La Rue, Ohio	11	Apr. 17	Apr. 22	12.8	Apr. 21.
Prospect, Ohio	10	Apr. 19	Apr. 23	12.0	Apr. 22.
Chillicothe, Ohio	16	Apr. 19	Apr. 23	23.9	Apr. 21.
Little Miami: Kings Mills, Ohio	17	Apr. 19	Apr. 21	26.8	Apr. 20.
Miami: Middletown, Ohio	15	Apr. 19	Apr. 20	15.7	Apr. 20.
Barren: Bowling Green, Ky.	20	Apr. 1	Apr. 2	20.8	Apr. 2.
Green:					
Munfordville, Ky.	28	Apr. 2	Apr. 2	28.4	Apr. 2.
Lock No. 4, Woodbury, Ky.	33	Apr. 2	Apr. 3	34.3	Apr. 3.
		Apr. 20	Apr. 24	36.9	Apr. 22.
Lock No. 2, Rumsey, Ky.	34	Apr. 20	4	39.9	Apr. 27.
West Fork of White:					
Anderson, Ind.	10	Apr. 18	Apr. 23	12.8	Apr. 21.
Elliston, Ind.	18	Apr. 18	Apr. 25	25.05	Apr. 20.
Edwardsport, Ind.	12	Apr. 18	Apr. 29	19.1	Apr. 21.
		2	5	13.8	4.
East Fork of White:					
Seymour, Ind.	14	Apr. 19	Apr. 23	18.4	Apr. 20.
Williams, Ind.	10	Apr. 21	Apr. 27	17.9	Apr. 23.
Shoals, Ind.	25	Apr. 23	Apr. 27	28.9	Apr. 25.
White:					
Petersburg, Ind.	16	Apr. 19	3	23.3	Apr. 26.
Hazleton, Ind.	16	Apr. 20	5	24.5	Apr. 27.
Wabash:					
Bluffton, Ind.	10	Apr. 21	Apr. 23	11.6	Apr. 22.
Wabash, Ind.	12	Apr. 21	Apr. 23	12.6	Apr. 23.
Lafayette, Ind.	11	Apr. 22	Apr. 23	11.3	Apr. 23.
Mt. Carmel, Ill.	17	Apr. 21	4	21.1	Apr. 27.
New Harmony, Ind.	15	Apr. 24	3	16.6	Apr. 30.
Cumberland:					
Celina, Tenn.	28	Mar. 31	Apr. 4	35.3	Apr. 2.
		Apr. 21	Apr. 25	35.0	Apr. 23.
Lock F, Eddyville, Ky.	50	Apr. 26	Apr. 29	51.1	Apr. 28.
Ohio:					
Pittsburgh, Pa.	25	Mar. 31	Apr. 2	28.5	Mar. 31.
		Apr. 20	Apr. 22	28.3	Apr. 21.
Coraopolis, Pa.	26	Mar. 31	Apr. 1	26.7	Apr. 1.
		Apr. 20	Apr. 21	27.0	Apr. 21.
Dam No. 7, Midland, Pa.	30	Mar. 31	Apr. 2	37.0	Apr. 1.
		Apr. 5	Apr. 5	31.0	Apr. 5.
		Apr. 20	Apr. 23	39.6	Apr. 21.
Dam No. 12, near Wheeling, W. Va.	36	Apr. 1	Apr. 2	38.05	Apr. 1.
		Apr. 20	Apr. 23	42.6	Apr. 21.
Marietta, Ohio	35	Apr. 20	Apr. 24	44.5	Apr. 22.
Parkersburg, W. Va.	36	Apr. 20	Apr. 24	44.8	Apr. 22.
Dam No. 19, Little Hocking, Ohio	40	Apr. 20	Apr. 24	47.7	Apr. 22.
Dam No. 20, near Belleville, W. Va.	45	Apr. 21	Apr. 23	48.0	Apr. 22.

[1] Continued from preceding month.

FLOOD-STAGE REPORT FOR MAY 1940—Continued

River and station	Flood stage	Above flood stages—dates From—	To—	Crest Stage	Date
MISSISSIPPI SYSTEM—continued					
Ohio Basin—Continued					
Ohio—Continued.	*Feet*			*Feet*	
Dam No. 22, Ravenswood, W. Va.	44	Apr. 20	Apr. 24	51.2	Apr. 22.
Point Pleasant, W. Va.	40	Apr. 20	Apr. 25	51.6	Apr. 23.
Gallipolis Dam, Hogsett, W. Va.	50	Apr. 21	Apr. 25	57.1	Apr. 23.
Dam No. 28, Huntington, W. Va.	50	Apr. 21	Apr. 26	56.7	Apr. 23.
Dam No. 29, Ashland, Ky.	51	Apr. 21	Apr. 26	60.4	Apr. 23.
Dam No. 30, near Greenup, Ky.	52	Apr. 21	Apr. 26	61.0	Apr. 23–24.
Portsmouth, Ohio	50	Apr. 21	Apr. 27	59.7	Apr. 24.
Dam No. 32, near Vanceburg, Ky.	53	Apr. 21	Apr. 27	60.1	Apr. 24.
Dam No. 33, near Maysville, Ky.	50	Apr. 21	Apr. 27	59.5	Apr. 24.
Dam No. 35, New Richmond, Ohio.	48	Apr. 21	Apr. 28	56.4	Apr. 24.
Dam No. 36, near Brent, Ky.	52	Apr. 20	Apr. 28	60.05	Apr. 24.
Cincinnati, Ohio	52	Apr. 20	Apr. 28	60.04	Apr. 24.
Dam No. 37, Fernbank, Ohio	50	Apr. 20	Apr. 28	58.95	Apr. 24.
Dam No. 38, near Grant, Ky.	51	Apr. 20	Apr. 28	58.2	Apr. 25.
Dam No. 39, Markland, Ind.	48	Apr. 21	Apr. 28	52.4	Apr. 25.
Louisville, Ky.:					
Upper gage	28	Apr. 21	Apr. 29	35.0	Apr. 26.
Lower gage	55	Apr. 21	Apr. 29	61.9	Apr. 26.
Dam No. 43, Evans Landing, Ind.	57	Apr. 21	Apr. 29	62.9	Apr. 26.
Dam No. 44, Leavenworth, Ind.	53	Apr. 21	Apr. 30	62.1	Apr. 26.
Dam No. 45, near Addison, Ky.	47	Apr. 21	1	53.6	Apr. 26–27.
Tell City, Ind.	38	Apr. 21	2	45.5	Apr. 26–27.
Dam No. 46, Owensboro, Ky.	41	Apr. 22	1	44.3	Apr. 27–28.
Dam No. 47, Newburgh, Ind.	38	Apr. 20	4	46.1	Apr. 27–28.
Evansville, Ind.	37	Apr. 21	4	43.75	Apr. 28.
Dam No. 48, Cypress, Ind.	38	Apr. 21	4	46.1	Apr. 28–29–30.
Mount Vernon, Ind.	35	Apr. 21	5	44.3	Apr. 30.
Dam No. 49, Uniontown, Ky.	37	Apr. 22	6	46.4	1.
Shawneetown, Ill.	33	Apr. 20	7	47.0	1.
Dam No. 50, Fords Ferry, Ky.	34	Apr. 20	8	49.7	1.
Dam No. 51, Golconda, Ill.	40	Apr. 23	6	45.6	1–2.
Paducah, Ky.	39	Apr. 27	6	41.8	2.
Dam No. 52, Brookport, Ill.	37	Apr. 22	7	43.5	2, 3.
Dam No. 53, Grand Chain, Ill.	42	Apr. 22	7	47.7	3.
Cairo, Ill.	40	Apr. 23	7	44.6	3.

FLOOD-STAGE REPORT FOR MAY 1940—Continued

River and station	Flood stage	Above flood stages—dates From—	To—	Crest Stage	Date
MISSISSIPPI SYSTEM—continued					
White Basin					
Black: Black Rock, Ark.	*Feet* 14	Apr. 19	6	*Feet* 18.2	1.
White: St. Charles, Ark.	25	Apr. 26	17	26.1	1–3.
Arkansas Basin					
North Canadian: Yukon, Okla.	8	22	25	10.4	22.
Red Basin					
Ouachita: Arkadelphia, Ark.	17	1	1	17.2	1.
Little: Whitecliffs, Ark.	25	22	22	25.0	22.
		27	June 1	25.7	30–31.
Sulphur:					
		(1)	3		
Ringo Crossing, Tex.	20	10	11	22.5	10.
		20	26	23.1	22. 4
		27	June 2	24.0	29.
Naples, Tex.	22	3	8	24.8	4–5.
		26	June 7	26.2	June 2.
Lower Mississippi Basin					
Big Lake Outlet: Manila, Ark.	10	(1)	13		
St. Francis:					
Fisk, Mo.	20	3	4	21.05	4.
St. Francis, Ark.	18	(1)	8		
WEST GULF OF MEXICO DRAINAGE					
Trinity:					
Dallas, Tex.	28	30	30	28.0	30.
Trinidad, Tex.	28	19	24	31.7	22.
Rio Grande: Espanola, N. Mex.	6	20	20	6.0	20.
PACIFIC SLOPE DRAINAGE					
San Joaquin Basin					
Kings: Piedra, Calif.	10	11	11	10.15	11.
		15	16	10.25	15.
		25	25	10.3	25.

[1] Continued from preceding month.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[Marine Division, WILLIS E. HURD Acting in Charge]

NORTH ATLANTIC OCEAN, MAY 1940

By H. C. HUNTER

Atmospheric pressure.—The pressure averaged higher than normal over waters near the Iberian peninsula, Newfoundland, and eastern Canada. Just to eastward of the United States the average pressure was lower than normal; and there was an even more marked deficiency around the Azores, where low readings were prevalent from the 3d to 10th and again from the 22d to the 26th.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, May 1940*

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Lisbon, Portugal	1,017.4	+2.5	1,026	29	1,010	1, 2
Horta, Azores	1,017.8	−3.5	1,031	15	994	24
Belle Isle, Newfoundland[1]	1,015.4	+3.2	1,030	17	995	14
Halifax, Nova Scotia	1,016.0	+1.1	1,030	21	999	13
Nantucket	1,014.2	−1.4	1,025	30	1,001	4
Hatteras	1,013.2	−3.1	1,026	6	1,002	2
Turks Island	1,014.5	−1.4	1,019	6	1,007	19
Key West	1,014.9	0.0	1,024	6	1,009	24
New Orleans	1,014.9	0.0	1,025	6	1,006	24

[1] For 24 days.

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

The extremes of pressure in available vessel reports were 1038.0 and 992.9 millibars (30.65 and 29.32 inches). The higher reading was noted by two vessels, near 41° N., 43° W., on the morning of the 5th. The low was recorded on the American liner *Exeter* at a late hour of the 23d, at about latitude 43° N., 36° W. The pressure was almost equally low during the forenoon of the 3d about 200 miles to southeastward of the mouth of Delaware Bay.

Cyclones and gales.—The month seems to have been less stormy over the North Atlantic Ocean than the average May, though a considerable number of vessels encountered fresh gales (force 8). There has been but one report received of a force as great as 10.

A well-developed LOW affected much of the eastern North Atlantic from the 3d to the 6th, being central on the former date to northwestward of the Azores and on the latter date near Iceland. The only whole gale of the month was met by the Dutch liner *Blommersdijk*, near 48° N., 27° W., during the night of the 4–5th.

Another storm of importance came soon after the middle of the month, the center being over or near Maine on the morning of the 18th, with only moderate strength. Eastward movement brought the center to a position slightly east of Newfoundland by the 20th, and to about 51° N., 26° W., by the 23d. The storm was by this latter date more intense, and a long trough extended from the center toward the south-southwest. The succeeding two days

showed but little advance, though there was considerable loss of strength.

Tropical disturbance.—Below is an account of a tropical disturbance which was traced from the 18th to the 27th, originating near Turks Island and disappearing near Newfoundland. It caused no very intense winds; its movement was northward near the 72d meridian till about in the latitude of the Chesapeake Capes, then eastward or northeastward at a comparatively low speed.

Fog.—There was considerable fog during the period 21st to 25th within the 5°-square, 30° to 35° N., 70° to 75° W. This square lies about midway between Bermuda and the coasts of Georgia and South Carolina, and during part of this time the weather was greatly affected by the LOW already referred to as moving northward from the tropics.

Farther northward the region near the coast, as far as Cape Cod, had almost daily fog from the 20th onward, though there had been comparatively little before the 20th. The square 40° to 45° N., 70° to 75° W., reported fog on 14 days, and the square adjoining this to southward, on 13 days; these two squares are indicated as having much more fog than any others in North Atlantic waters. For localities to eastward and northeastward of Cape Cod, as far as the 55th meridian, a moderate number of fog reports are at hand, the majority of these being for days after the 20th.

From the Grand Banks region reports are not plentiful, but some fog is shown to have occurred, mainly about the 7th or the 20th.

TROPICAL DISTURBANCE OF MAY 18–27, 1940

By JEAN H. GALLENNE

The first tropical disturbance of the 1940 season was of minor intensity throughout its entire existence. The depression originated a short distance to the southeast of Turks Island during the evening of May 18 and moved in a general northerly direction for a period of about 4 days; thereafter its progressive motion was toward the east and northeast, where its identity was lost in the area between Nova Scotia and Newfoundland on the morning of May 27.

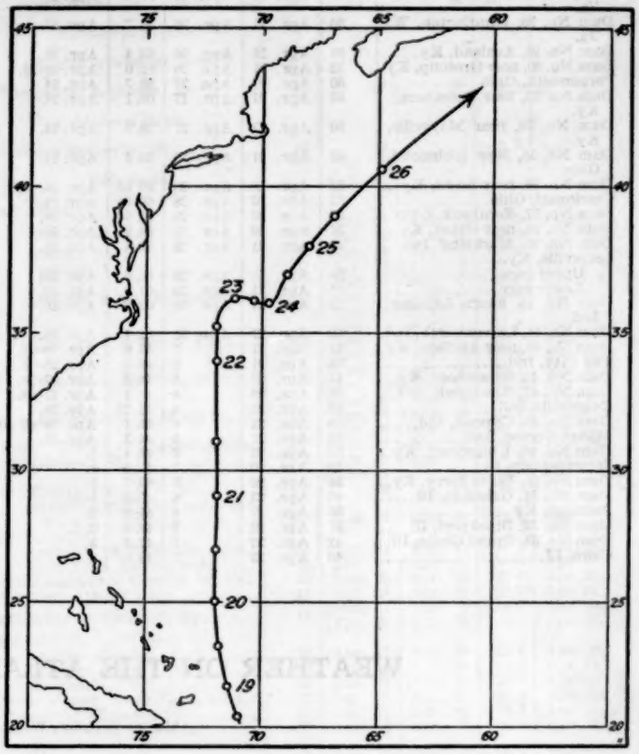
A slight fall of barometric pressure was charted in the region near Puerto Plata and Turks Island on the evening of May 18. At that time cloudy weather, gentle east winds, and a barometer reading of 1,007.8 millibars (29.76 inches) where observed at Turks Island. However, during the next 12 hours the wind at that station shifted to the southwest, increasing to force 5, while the barometer continued to fall gradually to 1,007.1 millibars (29.74 inches).

On the morning of May 19, a rather well-defined cyclonic circulation was observed, with the center of low pressure near latitude 22°45′ N., and longitude 71°30′ W. Winds of force 5–6 were noted in the northerly quadrant of the disturbance at this stage. (See figure.)

During the next 36 hours the disturbance moved in a general northerly direction, and reports from ships during that period indicate that strong to high winds were experienced over a considerable area.

Between 5 a. m. and 6 a. m. on May 21, the Belgian M. S. *Good Gulf* near latitude 30°12′ N., and longitude 71° W. reported a barometer reading of 1,002.7 millibars (29.61 inches); wind southeast, force 8; heavy rain and very rough seas. The Belgian M. S. *Lubrafol* at midnight of the same day reported an easterly gale with a barometer reading of 995.6 millibars (29.40 inches) when near latitude 32°21′ N., and longitude 71°52′ W. This is the lowest barometer reading of record in connection with the disturbance. Several other vessels reported strong shifting winds and disturbed conditions on May 21.

The center was located near latitude 34° N., and 72° W. on the morning of the 22d; and from reports at hand, indications are that the barometric pressure had risen



somewhat as compared to that of the previous day and that the disturbance had become less violent.

At the morning observation of May 23, the disturbance was centered near latitude 36°15′ N., and longitude 71°15′ W. The progressive motion was then toward the east or slightly east-southeast, and on the following morning the center was at approximately 36° N., and 69°45′ W. From that point it moved toward the northeast for the next 3 days and apparently merged with an area of low barometric pressure to the southwest of Newfoundland.

Gale winds of force 8 were the highest recorded in connection with this disturbance and no unusually low pressure was observed. No loss of life nor property damage has been reported.

Advisory warnings of the disturbance were issued by the Forecast Center at Jacksonville, Fla., on May 19 to 21.

This disturbance was unusual, in that from 1887 to date only four other occurrences of tropical cyclones have been recorded in the month of May; none was of hurricane intensity.

OCEAN GALES AND STORMS, MAY 1940

Vesse	Voyage		Position at time of lowest barometer		Gale began May	Time of lowest barometer, May	Gale ended May	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				*Millibars*					
Bibb, U. S. C. G.	Horta	Station No. 2	40 00 N.	40 48 W.	2	3p, 2	2	1,003.4	SSW	WSW, 8	NW	SW, 9	SW-WNW.
Breedijk, Du. S. S.	Rotterdam	New York	48 36 N.	26 30 W.	3	10a, 3	4	997.6	N	N, 6	NNW	N, 8	
Gulfhawk, Am. M. S.	Guiria	do	35 00 N.	71 45 W.	3	12p, 3	4	1,010.2	S	WSW, 8	W	WSW, 8	WSW-NW.
Blommersdijk, Du. S. S.	Rotterdam	do	48 03 N.	25 08 W.	4	12m, 4	5	[2] 999.5	NE	ESE, 5	NE	NE, 10	SE-NE.
Leto, Du. S. S.	do	Norfolk	38 12 N.	68 24 W.	4	8a, 5	4	1,009.1	S	SW, 4		S, 8	
Elizabeth van Belgie, Belg. S. S.	Antwerp	Charleston	38 42 N.	24 36 W.	5	4a, 6	6	1,004.0	SW	S, 6	S	SW, 8	SSW-SSE.
Bibb, U. S. C. G.	Station No. 2	Morehead City, N. C.	37 24 N.	60 06 W.	5	5a, 6	5	1,019.0	SSE	WSW, 6	S	S, 8	S-WSW.
Monbaldo, Ital. S. S.	Cadiz	New Orleans	34 54 N.	52 24 W.	9	11p, 9	9	998.6	S	S, 8	SW	S, 8	
J. A. Moffett, Jr., Am. M. S.	Cartagena	Montreal	39 25 N.	63 44 W.	12	9a, 12	12	1,001.0	NE	SSE, 4	E	NE, 8	NE-S.
Artigas, Am. S. S.	Poti, U. S. S. R.	Baltimore	35 05 N.	56 00 W.	13	3p, 13	13	1,010.5	SE	SSE, 9	WNW	SSE, 9	SSE-SW.
Extavia, Am. S. S.	Lisbon	New York	[1] 37 12 N.	53 21 W.	13	6p, 13	13	1,016.3	S	S, 8	S	S, 8	S-W.
Penniand, Du. S. S.	Antwerp	do	41 06 N.	54 42 W.	13	11p, 13	14	1,012.2	S	SSW, 9	NW	SSW, 9	
Kainalu, Am. S. S.	Gibraltar	do	40 06 N.	52 48 W.	13	1a, 14	14	1,015.9	SSE	SW, 7	W	S, 8	S-W.
Ingham, U. S. C. G.	On station No. 1		39 24 N.	59 12 W.	14	8p, 14	15	1,018.6		SW, 9		SW, 9	
Chelan, U. S. C. G.	On ice patrol	Out from Boston.	48 24 N.	48 42 W.	21	3p, 20	23	1,000.7	N	SW, 4	NNW	NNW, 9	SW-NW.
Good Gulf, Belg. M. S.	New York	Las Piedras, Venezuela.	30 12 N.	71 00 W.	20	6a, 21	21	1,002.7	E	SE, 8	SSW	SE, 8	SE-SSE.
Darien, Pan. S. S.	St. John, N. B.	Kingston	31 22 N.	71 00 W.	21	8p, 21	22	998.3	E	SE, 6	W	SW, 8	E-S.
Lubrafol, Belg. M. S.	New York	Aruba	[1] 32 21 N.	71 52 W.	21	12p, 21	22	[2] 995.6	E	E, 5	W	E, 8	E-S-W.
Amapala, Hond. S. S.	Ceiba	New York	36 50 N.	74 10 W.	22	12p, 22	23	1,004.7	N	NNW, 7	N	NNW, 8	NNW-N.
Gulfpoint, Am. S. S.	Port Arthur	Providence	37 47 N.	74 17 W.	22	2a, 23	23	1,005.1	N	NNE, 7	NNE	NNE, 8	N-NNE.
Hamilton, U. S. C. G.	On station No. 2	Out from Norfolk.	40 30 N.	44 00 W.	21	1p, 23	23	1,007.1	WNW	NW, 8	NW	WNW, 8	WNW-NW.
Exilona, Am. S. S.	Cadiz	New York	40 30 N.	28 54 W.	23	4a, 24	25	993.6	WSW	W, 2	NNW	WSW, 8	W-NW.
Mormactide, Am. S. S.	Galveston	Quebec	36 40 N.	72 48 W.	23	2p, 24	24	1,004.7	NNW	N, 5	N	NNW, 8	N-NW.
Pontchartrain, U. S. C. G.	On station No. 1	Out from New York.	39 00 N.	59 00 W.	26	2a, 26	26	1,022.0	SE	SE, 7	SE	SE, 8	
Spencer, U. S. C. G.	On station No. 2	do	40 12 N.	43 36 W.	28	3p, 28	28	1,014.6	SSW	SW, 6	SSW	SW, 8	SSW-WSW.
Chelan, U. S. C. G.	Ice patrol	Boston	47 24 N.	51 48 W.	31	3a, 30	31	1,008.8	SW	SW, 4	SW	SW, 8	
NORTH PACIFIC OCEAN													
Meigs, U. S. A. T.	Manila	San Francisco	41 45 N.	122 40 W.	1	10a, 1	1	997.6	SSW	SSE, 9	SW	SW, 9	
Mapele, Am. S. S.	Columbia River	Honolulu	41 28 N.	132 54 W.	1	4p, 3	4	999.0	SSW	WNW, 6	NNW	SSE, 8	
Swiftsure Bank Lightship, U. S.	On station		48 33 N.	125 00 W.	1	8p, 1	2	1,001.0	SE	SE, 7	SE	SE, 8	
Huguenot, Am. S. S.	Portland, Oreg.	Long Beach	45 36 N.	124 25 W.	4	8a, 4	4	1,002.4	S	S, 7	SW	SW, 8	
Yaka, Am. S. S.	Manila	San Francisco	38 30 N.	152 54 W.		2p, 4		1,005.8		SW, 5		SSW, 8	
Bridge, U. S. S.	San Diego	do	[1] 35 24 N.	121 12 W.	10	3p, 10	10	1,011.5	NW	NW, 8	NNW	NW, 8	W-NW.
Discoverer, U. S. C. & G. S.	Surveying near Unimak Island.		55 18 N.	162 18 W.	10	4a, 11	11	1,009.5	NNW	N, 8	N	NNW, 11	
Bralanta, Nor. M. S.	Yokohama	Los Angeles	38 30 N.	142 30 W.	12	2p, 12	12	988.2		SSE, 8		SSE, 8	
Bahrein, Pan. S. S.	Dairen	do	42 10 N.	139 12 W.	12	3a, 13	13	984.4	ESE	S, 10	WSW	SSE, 12	SE-SW.
City of Alma, Am. S. S.	Victoria, B. C.	Honolulu	42 42 N.	134 54 W.	12	8a, 13	13	1,005.8	S	SE, 9	WSW	SE, 9	SE-SSW.
Santa Maria, Pan. S. S.	Los Angeles	Ioco, B. C.	38 50 N.	123 42 W.	15	4p, 15	16	1,013.9	NW	WNW, 7	NW	NW, 8	NW-WNW.
Discoverer, U. S. C. & G. S.	Surveying near Alaska Peninsula.		55 00 N.	161 54 W.	21	2a, 21	22	1,001.7	NNW	NNW, 5	NNW	NNW, 10	None.
Huguenot, Am. S. S.	Los Angeles	Seattle	40 15 N.	124 30 W.	25	12m, 26	26	1,013.5	NW	NW, 8	NW	NW, 8	None.
Toa Maru, Jap. M. S.	Osaka	Los Angeles	[1] 42 34 N.	153 59 E.	27	10p, 26	29	[2] 996.3	NW	N, 7	W	WNW, 8	ENE-NW.
San Luis Maru, Jap. M. S.	Yokohama	do	45 18 N.	175 12 W.	30	12p, 30	31	[2] 978.6		ESE, 3	WNW	WNW, 9	
Toa Maru, Jap. M. S.	Osaka	do	46 56 N.	163 27 W.	30	12p, 30	[3] 2	[2] 990.0	SE	S, 6	W	SW, 8	ESE-SSW.
City of Los Angeles, Am. S. S.	Yokohama	San Francisco	48 00 N.	161 00 W.	30	6a, 31	[3] 2	983.7	ESE	SW, 7	SW	WSW, 10	SSW-SW.

[1] Position approximate. [2] Barometer uncorrected. [3] June.

NORTH PACIFIC OCEAN, MAY 1940

By WILLIS E. HURD

Atmospheric pressure.—In May the change from winter to spring conditions of pressure was rapid. The Aleutian LOW was abnormally deep in April 1940, but in May it became practically normal, with a long trough of low pressure, approximately 1,009 millibars (29.80 inches), extending from the Alaska Peninsula westward across the Aleutians.

In middle latitudes the North Pacific anticyclone was well developed and of broad extent. On several days it extended in middle longitudes from the upper Tropics northward to the Aleutians. On the average, its eastern boundary touched the American coast between latitudes 40° and 55° N., while its western boundary, in lower latitudes, extended far into east longitudes. At Midway Island the average pressure, 1,022.2 millibars (30.18 inches), was 4.6 millibars (0.13 inch) above the normal of the month.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure at sea level, North Pacific Ocean, May 1940, at selected stations*

Stations	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Millibars	*Millibars*	*Millibars*		*Millibars*	
Point Barrow [1]						
Dutch Harbor	1,008.4	−2.1	1,027	7, 8	991	29
St. Paul	1,010.7	−0.5	1,029	7	996	29
Kodiak	1,009.8	−0.7	1,024	7	991	18
Juneau	1,015.2	−0.4	1,025	6	988	2
Tatoosh Island	1,018.0	+1.7	1,028	16	1,002	1
San Francisco	1,014.9	−0.7	1,022	7	1,008	20
Mazatlan	1,011.0	+0.2	1,014	6, 7	1,009	20, 21, 29
Honolulu	1,015.9	−1.7	1,020	2	1,010	11
Midway Island	1,022.2	+4.6	1,026	6, 24	1,015	15
Guam	1,012.0	+0.1	1,016	28	1,010	5, 16, 21–23
Manila	1,009.4	+1.3	1,013	11	1,005	22
Hong Kong	1,008.8	+0.3	1,014	18	1,003	31
Naha	1,011.1	+1.3	1,017	2	1,004	31
Titijima	1,013.4	+0.5	1,020	3	1,006	30
Petropavlovsk	1,008.8	−1.2	1,028	17	978	10

[1] Data lacking.

NOTE.—Data based on 1 daily observation only, except those for Juneau, Tatoosh Island, San Francisco, and Honolulu, which are based on 2 observations. Departures are computed from best available normals related to time of observation.

Extratropical cyclones and gales.—Most cyclonic disturbances of the month moved in the higher latitudes; and over the western two-thirds of the ocean no gales were reported by ships to the southward of the 40th parallel. Over the eastern third, a few fresh gales occurred between latitudes 35° and 40° N., in connection with cyclones centered well to the northward on the 1st, 4th, and 12th. The stormy weather of the month occurred mainly to the eastward of the 180th meridian; west of that meridian the only wind of force as high as 8 reported was experienced near latitude 43° N., 154° E., on the 27th.

At the beginning of May a moderate cyclone lay to the westward of Washington and Oregon from the 1st to the 4th, and caused strong winds to fresh southerly gales, particularly along the coast. Much farther westward, on the 4th to 6th, a further moderate cyclone lay over the northern routes to the southeastward of the Aleutian Islands, and caused widely scattered winds of forces 7 to 8 within the region 38° to 47° N., 150° to 165° W.

Late on the 12th and early on the 13th the locally most violent storm of the month along the main lines of travel was centered in the vicinity of 45° N., 140° W. At about 2 a. m. of the 13th the Panamanian steamer *Bahrein* encountered intense squalls of rain and wind, the highest velocity attaining full hurricane force from the south-southeast. At 3 a. m. the wind had lessened to force 10 from the south, with lowest barometer 984.4 millibars (29.07 inches), in 42°10′ N., 139°12′ W. At 8 a. m. of the same date the American steamer *City of Alma*, near 43° N., 135° W., reported a southeast gale of force 9, lowest barometer 1,005.8 millibars (29.70 inches).

In higher latitudes of the Pacific, the U. S. Coast and Geodetic Survey steamer *Discoverer*, near Unimak Island, off the Alaska Peninsula, encountered a north-northwest gale of force 11 on the 10th, and another of force 10 from the same direction on the 22d. Both occurrences were evidently local in character.

From May 27 to 31 a cyclone from the vicinity of the Kuril Islands crossed the central Aleutian chain, and at the close of the month lay south and southwest of the Alaska Peninsula. This storm was particularly notable on the 30th and 31st. On the 30th because on that date the Japanese motorship *San Luis Maru* reported what is probably the lowest barometer reading of the month in the North Pacific, 976.6 millibars (28.84 inches, uncorrected), near 45° N., 175° W.; on the 31st, because of the storm activity. Several eastbound vessels had westerly gales between latitudes 45° and 50° N., longitudes 155° and 170° W., of which the strongest, of force 10, was reported by the American steamer *City of Los Angeles*, near 48° N., 157° to 158° W.

Near the California coast northwesterly gales of force 8 were reported by ships on the 10th, 15th, 16th, 25th, and 26th, along the eastern slope of the oceanic HIGH.

Fog.—In northwestern waters the fog conditions usual to late spring made their appearance this month. Along the upper steamship routes between longitude 175° W., and northern Japan fog was observed on 3 to 6 or more days in each five-degree square. Only scattered fogs occurred elsewhere, except along the American coast. Two days with fog were reported off Washington; 3, off Oregon; 18, off California; and 4, off Lower California.

CLIMATOLOGICAL TABLES

CONDENSED CLIMATOLOGICAL SUMMARY

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations

TABLE 1.—*Condensed climatological summary of temperature and precipitation by sections, May 1940*

[For description of tables and charts, see REVIEW, January, pp. 32 and 38]

Section	Temperature								Precipitation					
	Section average	Departure from the normal	Monthly extremes						Section average	Departure from the normal	Greatest monthly		Least monthly	
			Station	Highest	Date	Station	Lowest	Date			Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	69.0	−2.4	2 stations	97	22	2 stations	34	4	3.45	−0.67	Melvin	8.14	Fairhope	0.53
Arizona	69.4	+3.4	Gila Bend	110	14	Alpine	22	5	.33	+.01	Alpine	1.56	9 stations	.00
Arkansas	66.6	−2.5	England	96	5	2 station	33	2	3.62	−1.33	Grannis	11.51	Lead Hill	.63
California	64.0	+2.6	2 stations	111	[1] 13	Soda Springs	12	5	.63	−.31	Upper Mattole	5.21	70 stations	.00
Colorado	55.4	+3.0	Sedgwick	100	31	Hermit	15	1	1.74	−.14	Monument	4.63	3 stations	.00
Florida	72.9	−2.6	Quincy	99	22	3 stations	38	[1] 3	1.99	−1.97	Miami	11.11	Inverness	.20
Georgia	69.3	−2.2	Alapaha	98	22	Blairsville	29	5	2.14	−1.29	Quitman	6.20	Savannah Beach	.67
Idaho	57.0	+3.9	Riggins	100	10	Pelton's Ranch	12	7	.55	−1.07	Pierce	3.17	7 stations	.00
Illinois	60.0	−2.7	2 stations	92	[1] 6	3 stations	27	4	3.24	−.78	Cicero	6.24	U.S. Dam 21 (Quincy)	.94
Indiana	59.0	−3.2	Shoals	97	8	Marengo	25	4	4.14	+.15	Wheatfield	7.82	Evans Landing	1.80
Iowa	58.4	−1.7	4 stations	96	13	3 stations	26	[1] 1	2.07	−1.96	Cedar Falls	3.86	Inwood	.16
Kansas	63.9	.0	Medicine Lodge	102	5	Atwood	30	15	3.76	−.07	Minneola	8.09	Hanover	1.11
Kentucky	61.8	−3.6	Pikeville	94	[1] 7	Lynch (near)	26	4	3.50	−.47	Flemingsburg	6.10	Pikeville	1.71
Louisiana	71.9	−1.8	Winnfield	94	[1] 20	Belle Chasse	45	13	1.89	−2.64	Monroe	5.45	Gueydan (near)	.00
Maryland-Delaware	62.0	−.7	Dunkalk, Md	93	14	Oakland, Md	23	12	4.55	+1.06	Emmitsburg, Md	8.94	Delaware Breakwater, Del.	2.63

[1] Other dates also.

TABLE 1.—*Condensed climatological summary of temperature and precipitation by sections, May 1940*—Continued

Section	Temperature								Precipitation					
	Section average	Departure from the normal	Monthly extremes						Section average	Departure from the normal	Greatest monthly		Least monthly	
			Station	Highest	Date	Station	Lowest	Date			Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Michigan	52.0	−1.5	Eloise	92	[1]13	2 stations	19	[1]4	3.93	+.74	Bergland	7.71	Mackinaw City	2.10
Minnesota	54.2	−1.0	Fairbault	96	12	do	20	[1]2	1.91	−1.27	Two Harbors	4.57	Baudette	.35
Mississippi	69.2	−2.6	3 stations	95	[1]17	West Point	35	2	2.59	−1.73	Shubuto	8.27	Biloxi	.57
Missouri	62.7	−1.8	2 stations	95	[1]6	Goodland	30	4	2.44	−2.29	2 stations	5.75	Philadelphia	.32
Montana	55.7	+3.6	5 stations	95	31	Conway's Ranch	15	7	1.19	−.90	Billings No. 2	3.76	2 stations	.24
Nebraska	60.1	+.8	3 stations	99	[1]12	Mullen	20	14	1.07	−2.34	Winside	4.36	Springview	.00
Nevada	61.9	+6.2	Overton	110	17	Sheldon	17	5	.23	−.63	Lewers Ranch	1.36	6 stations	.00
New England	54.9	−.2	Orono, Maine	92	27	2 stations	22	[1]9	4.60	+1.25	Mt. Carmel, Conn.	9.64	Jackman, Maine	.93
New Jersey	59.7	−.7	N. Merchantville	92	15	Layton	28	10	6.32	+2.64	Elizabeth	9.12	Barnegat City	4.33
New Mexico	61.1	+1.5	Orogrande	102	31	Eagle Nest	15	1	1.85	+.65	Santa Clara R. S.	5.74	Shiprock	.16
New York	56.4	+.4	Binghamton	88	15	3 stations	21	[1]10	3.78	+.35	Scarsdale	7.99	Lawrenceville	1.25
North Carolina	65.4	−1.4	Shelby	100	8	Mount Mitchell	17	[1]3	3.81	−.25	Hatteras	11.69	Canton	1.16
North Dakota	54.9	+1.3	Berthold Agency	96	11	Mohall	17	1	1.97	−.32	Portal	4.58	Richardton	.39
Ohio	58.6	−1.9	Gallipolis (near)	95	22	Millport	26	5	4.51	+.84	Hillsboro	7.09	Dam No. 28	2.12
Oklahoma	68.2	−.1	Mutual	105	5	Kenton	31	1	3.87	−.82	Ardmore	12.74	Okmulgee	1.08
Oregon	56.8	+3.5	Umatilla	98	23	Fremont	18	6	.97	−.72	Gold Beach	5.89	Andrews	.00
Pennsylvania	59.2	−.3	3 stations	93	14	Coudersport	22	12	4.46	+.62	Uniontown	7.31	Chambersburg	2.59
South Carolina	68.4	−2.5	2 stations	98	[1]7	Longcreek (near)	30	5	2.84	−.72	Pinopolis	5.64	Charleston Airport	.90
South Dakota	57.4	+1.0	Hot Springs	97	31	McIntosh	19	1	.61	−2.22	Lead	2.52	2 stations	.03
Tennessee	63.8	−3.0	Etowah	96	8	Erwin	27	5	3.29	−.87	Knoxville	5.13	Kingsport	1.26
Texas	72.6	−.4	2 stations	105	[1]4	Seminole	31	9	3.36	−.28	Arthur City	13.42	Orange	.29
Utah	60.4	+4.9	Hurricane	98	[1]9	Moon Lake	14	1	.23	−.97	Massey's Ranch	1.94	7 stations	.00
Virginia	63.4	−.7	Columbia	96	7	Burkes Garden	26	12	4.46	+.75	Roanoke	10.14	Clinchport	1.33
Washington	58.2	+3.7	Wahluke (near)	99	23	Newport	19	26	1.56	−.37	Mt. Baker Lodge	9.27	Ephrata	T
West Virginia	60.1	−1.6	3 stations	95	[1]8	Seneca State Forest	22	12	4.93	+.96	Buckhannon	9.04	Williamson	1.42
Wisconsin	52.7	−2.6	Wisconsin Dells	91	13	Willow Reservoir	16	4	3.63	+.05	Rest Lake	5.95	Mondovi	1.84
Wyoming	52.6	+3.0	Hawk Springs	96	31	Jewett's Ranch	9	7	.87	−1.18	Dome Lake	2.58	Lusk	.16
Alaska (April)	38.9	+12.1	Ruby	78	28	Pilgrim Springs	−21	3	1.53	+.05	Latouche	23.64	Richardson	.00
Hawaii	73.1	+1.8	2 stations	91	[1]15	Haleakala (Maui)	33	7	8.10	+1.88	Waikane	33.33	Mahukona	.00
Puerto Rico	77.0	+.3	Dos Bocas	97	12	3 stations	57	[1]3	13.44	+5.13	Guineo Reservoir	31.29	Mona Island (Light House).	4.07

[1] Other dates also.

TABLE 2.—*Climatological data for Weather Bureau stations, May 1940*

District and station	Elevation of instruments			Pressure			Temperature of the air									Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation			Wind						Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Barometer above sea level	Thermometer above ground	Anemometer above ground	Station, reduced to mean of 24 hours	Sea level, reduced to mean of 24 hours	Departure from normal	Mean max. + mean min. ÷2	Departure from normal	Maximum	Date	Mean maximum	Minimum	Date	Mean minimum	Greatest daily range				Total	Departure from normal	Days with 0.01 inch or more	Average hourly velocity	Prevailing direction	Maximum Velocity: Miles per hour	Maximum Velocity: Direction	Maximum Velocity: Date						
	Ft.	Ft.	Ft.	In.	In.	In.	°F.	°F.	°F.		°F.	°F.		°F.	°F.	°F.	°F.	%	In.	In.		Miles									0–10	In.	In.
New England							54.7	+0.1										77	4.79	+1.6										7.0		
Eastport	75	67	85	29.90	29.98	+0.02	47.8	+0.1	79	27	55	37	11	41	35	44	41	82	1.20	−1.8	10	10.8	e.	32	e.	24	5	11	15	6.8	0.0	0.0
Greenville, Me	1,070	6																													
Portland, Me	103	82	117	29.85	29.97	.00	52.7	−.6	76	27	60	38	11	46	25	49	45	80	5.82	+2.4	16	8.7	s.	26	s.	17	12	3	16	6.1	T	.0
Concord	288	54	72	29.58	29.95	−.03	55.9	+1.6	83	27	66	32	10	45	37	50	45	72	6.24	+3.2	15	5.9	ne.	22	nw.	7	3	10	13	6.2	.0	.0
Burlington	403	11	48	29.48	29.92	−.05	56.0	−.5	78	22	66	30	13	46	30	51	46	69	4.78	+1.9	16	7.5	s.	26	se.	2	5	8	18	6.8	.0	.0
Northfield	876	12	60	29.00	29.95	−.02	53.6	+.8	79	27	65	24	13	42	38	49	44	72	7.54	+4.8	14	7.6	sw.	25	s.	2	6	7	18	6.9	.0	.0
Boston [1]	125	106	165	29.91	29.94	−.04	56.2	−.9	75	19	64	43	13	49	26	50	45	71	3.28	+.1	14	11.7	s.	32	s.	11	4	12	15	7.0	.0	.0
Nantucket	12	14	90	29.94	29.95	−.04	53.7	+1.4	70	21	60	41	10	47	23	50	48	86	1.52	−1.3	15	14.1	s.	35	ne.	23	4	9	18	7.4	.0	.0
Block Island	26	11	46		29.94	−.05	53.1	+.3	70	14	60	42	13	47				88	3.31	−.2	15	13.9	s.	32	s.	2	7	12	12		.0	.0
Providence [2]	62	215	251	29.89	29.96	−.02	56.6	−1.9	75	7	64	43	12	49	26	51	47	80	5.01	+2.0	14	11.4	s.	37	nw.	7	5	11	15	7.0	.0	.0
Hartford [3]	159	122	....	29.97	29.93	−.05	58.0	+.5	80	15	68	36	13	48	35	52	48	75	7.04	+3.4	17	9.2	ne.	30	nw.	7	1	9	21	8.1	.0	.0
New Haven [2]	13	74	68	29.92	29.94	−.05	58.0	+.1	79	7	66	45	12	50	27	52	48	77	6.97	+3.3	16	8.9	n.	22	ne.	24	2	13	16	7.5	.0	.0
Middle Atlantic States							61.6	−0.4										72	4.18	+0.8										6.9		
Albany [1]	292	26	40	29.60	29.92	−.06	58.4	−.9	85	15	68	34	13	48	37	52	46	69	3.68	+.8	16	8.4	s.	33	nw.	7	4	8	19	7.7	.0	.0
Binghamton	871	57	79	29.00	29.93	−.05	58.2	+.8	88	15	68	30	12	48	42	51	47	71	3.71	+.4	16	6.3	se.	22	se.	19	1	10	20	7.8	.0	.0
New York	314	415	454	29.57	29.90	−.09	59.6	−1.0	79	14	67	42	12	52	22	53	47	70	6.84	+4.6	17	11.5	ne.	38	n.	7	4	8	19	7.4	.0	.0
Harrisburg [1]	374	94	104	29.53	29.91	−.07	62.0	+.2	92	14	72	42	10	52	40	54	49	69	3.56	+.1	18	8.9	e.	35	s.	15	3	10	18	7.1	.0	.0
Philadelphia	114	174	367	29.80	29.92	−.07	62.4	−.5	88	15	71	43	12	54	29	56	52	75	4.89	+1.6	17	12.7	ne.	34	s.	1	3	9	19	7.1	.0	.0
Reading	323	283	306	29.57	29.91		61.7	−.8	89	14	71	40	12	52	35	54	48	66	2.70	−1.0	16	11.4	se.	42	e.	31	8	9	14	6.3	.0	.0
Scranton	805	72	104	29.06	29.91	−.07	59.0	−.4	87	15	68	37	12	50	35	51	45	66	2.98	−.3	15	6.5	n.	26	nw.	11	3	10	18	7.2	.0	.0
Atlantic City	52	37	172	29.86	29.92	−.06	57.4	−.7	85	7	64	43	12	51	32	53	49	80	4.69	+1.6	14	17.3	s.	46	e.	31	2	14	15	7.2	.0	.0
Sandy Hook	22	10	57	29.90	29.92		57.5	−.9	79	14	64	45	12	52	26	53	50	82	5.39	+1.7	18	12.2	e.	34	s.	16	4	9	18	7.4	.0	.0
Trenton	190	89	107	29.71	29.91		61.0	−.1	88	15	70	41	12	52	32	54	49	71	5.93	+2.8	16	9.1	s.	26	s.	15	2	10	19	7.7	.0	.0
Baltimore [3]	16	100	215	29.89	29.91	−.08	64.4	.0	91	14	73	45	12	56	32	56	52	74	4.41	+.9	17	11.1	ne.	37	nw.	20	4	12	15	7.0	.0	.0
Washington	112	62	85	29.78	29.90	−.10	64.4	+.7	92	14	74	43	12	55	38	56	50	66	3.10	−.6	10	7.3	nw.	23	nw.	13	4	12	15	6.6	.0	.0
Cape Henry	18	8	54	29.89	29.91		64.2	.0	90	14	72	43	11	57	35	58	55	78	3.36	−.2	14	11.9	sw.	34	e.	30	8	12	11	6.1	.0	.0
Lynchburg	686	144	184	29.28	29.92	−.08	66.4	−.9	95	7	78	44	4	55	42	57	50	62	2.73	−.9	11	7.7	nw.	34	sw.	8	8	15	8	5.7	.0	.0
Norfolk [3]	91	80	125	29.82	29.92	−.08	66.3	+.1	91	14	75	45	4	58	31	59	55	73	3.64	−.2	13	10.3	s.	29	n.	22	7	8	16	6.8	.0	.0
Richmond [3]	164	11	52	29.73	29.90	−.09	66.3	−.1	94	7	76	43	12	56	37	58	54	74	4.65	+.9	13	8.0	sw.	25	sw.	1	8	11	12	5.9	.0	.0
Wytheville	2,304	49	55	27.55	29.93	−.06	59.0	−2.4	88	8	71	33	4	47	37	52	47	70	4.84	+1.2	16	6.7	w.	25	sw.	15	5	15	11	6.3	T	.0

See footnotes at end of table.

TABLE 2.—*Climatological data for Weather Bureau stations, May 1940*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum Velocity: Miles per hour	Wind: Maximum Velocity: Direction	Wind: Maximum Velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	Ft.	Ft.	In.	In.	In.	° F.	° F.	°F.		°F.	°F.		°F.	° F.	° F.	° F.	%	In.	In.		Miles							0–10	In.	In.
South Atlantic States							68.5	−1.7										68	3.17	−0.3									4.4		
Asheville	2,253	89	104	27.63	29.94	−0.05	62.2	−0.4	89	8	73	34	5	49	43	52	46	64	1.99	−1.4	9	7.8	nw.	27	nw.	9	10	12	9	4.9	0.0	0.0
Charlotte [2]	769	63	86	29.11	29.92	−.07	67.9	−1.0	96	8	79	39	4	56	35	58	52	67	3.92	+.3	13	7.1	sw.	26	nw.	9	7	11	13	5.7	.0	.0
Greensboro [1]	886	6	56	29.00	29.92		65.2		94	8	78	34	5	52	41	57	52	69	5.99		12	7.9	sw.	38	sw.	26	5	17	9	6.1	.0	.0
Hatteras	11	5	50	29.91	29.92	−.09	65.2	−3.5	79	27	71	49	12	60	21	62	60	84	11.69	+8.0	14	13.3	sw.	34	n.	12	11	7	13	5.6	.0	.0
Raleigh [2]	358	103	146	29.54	29.92	−.07	68.0	−.5	95	8	79	44	5	57	32	59	54	68	3.51	−.3	14	8.6	sw.	28	n.	8	14	14	3	4.0	.0	.0
Wilmington	72	73	107	29.86	29.93	−.08	68.6	−2.2	88	23	78	44	5	60	26	61	57	72	3.24	−.2	9	10.5	sw.	32	sw.	1	12	13	6	4.3	.0	.0
Charleston	48	11	92	29.90	29.95	−.06	70.2	−2.5	84	26	78	47	5	62	23	63	58	70	2.01	−1.0	9	10.4	s.	25	nw.	4	18	8	5	3.2	.0	.0
Columbia, S. C. [2]	225	70	91	29.70	29.93	−.07	69.4	−2.5	95	8	81	42	5	58	35	59	53	63	1.90	−1.2	8	8.5	s.	27	sw.	4	18	8	5	3.2	.0	.0
Greenville, S. C.	1,040	70	78	28.83	29.92		66.9	−.3	94	8	79	41	5	55	36	57	49	58	1.80	−2.2	11	7.5	sw.	26	sw.	2	13	9	9	4.2	.0	.0
Augusta [2]	426	62	77	29.48	29.93	−.06	70.4	−2.0	95	8	83	41	5	58	36	59	52	60	1.59	−1.4	10	6.0	nw.	24	n.	9	14	12	5	4.5	.0	.0
Savannah [2]	51	73	152	29.90	29.95	−.05	72.2	−1.2	94	23	83	48	4	62	29	62	58	71	.92	−2.1	7	10.5	sw.	39	w.	24	18	7	6	3.2	.0	.0
Jacksonville	43	86	110	29.92	29.97	−.03	72.8	−2.2	93	22	83	49	5	62	27	63	59	71	2.28	−1.7	9	8.0	sw.	21	sw.	3	17	11	3	3.3	.0	.0
Florida Peninsula							76.3	−1.0										72	4.45	+0.2									4.2		
Key West [2]	21	10	64	29.96	29.97	.00	78.1	−1.0	89	26	84	66	5	72	17	71	68	75	1.93	−1.6	5	9.5	e.	22	nw.	4	11	13	7	4.4	.0	.0
Miami	25	124	168	29.95	29.98	−.01	76.1	−.3	92	22	83	59	5	69	24	68	64	70	11.11	+4.9	6	9.3	se.	28	s.	30	10	13	8	5.2	.0	.0
Tampa [2]	11	88	197	29.97	29.98	−.01	74.6	−1.7	90	17	84	55	5	66	26	66	63	71	.31	−2.7	3	10.2	w.	24	nw.	4	21	8	2	3.1	.0	.0
East Gulf States							70.6	−1.9										67	1.83	−2.0									3.6		
Atlanta [1]	976	5	72	28.92	29.93	−.06	67.9	−2.0	94	8	80	40	4	56	40	57	50	59	2.03		10	9.8	nw.	42	nw.	26	14	11	6	4.2	.0	.0
Macon [2]	464	79	87	29.44	29.93	−.06	70.4	−1.9	95	7	83	43	4	58	37	58	51	57	.88	−2.1	8	6.5	nw.	25	nw.	26	16	10	5	3.8	.0	.0
Thomasville	273	49	58																												
Apalachicola	35	11	51	29.94	29.97		71.8	−2.8	87	30	80	54	3	64	22	65	62	73	1.08	−2.3	5	7.6	w.	26	se.	1	18	9	4	3.2	.0	.0
Pensacola	56	54	79	29.92	29.98	−.01	72.4	−1.5	87	23	81	53	3	64	27	64	60	70	1.24	−2.1	4	7.4	w.	25	w.	2	22	9	0	2.3	.0	.0
Anniston	741	9					66.9	−1.5	91	19	80	37	4	54	40				4.35		9		sw.				17	7	7		.0	.0
Birmingham [2]	630	11	48	29.30	29.96	−.02	68.0	−3.1	91	22	79	40	4	57	33	58	52	66	3.02	−.9	11	6.2	nw.	22	s.	1	12	15	4	4.0	.0	.0
Mobile [2]	29	86	161	29.94	29.98	−.01	72.2	−2.2	88	22	82	54	2	63	29	64	60	77	4.37	.0	7	9.2	s.	27	nw.	2	19	6	6	3.2	.0	.0
Montgomery [2]	237	92	105	29.71	29.96	−.03	71.2	−2.2	93	22	82	47	4	60	32	60	55	65	1.43	−2.4	9	6.9	n.	24	nw.	3	19	8	4	3.2	.0	.0
Meridian [2]	310	67	92	29.64	29.97	−.01	69.6	−1.7	91	21	82	47	2	58	35	60	56	72	1.70	−2.6	6	5.6	sw.	20	nw.	2	17	9	5	3.2	.0	.0
Vicksburg	247	82	102	29.70	29.96	−.01	71.1	−1.8	88	21	81	52	2	61	28	61	55	63	1.97	−2.4	5	7.5	sw.	27	w.	23	14	8	4	3.3	.0	.0
New Orleans [2]	30	76	84	29.94	29.97	.00	74.9	−.5	89	17	83	59	2	67	23	66	61	67	.78	−3.8	4	6.2	se.	20	nw.	2	17	9	5	3.7	.0	.0
Port Eads, La	9	4	35				72.3		86	28	79	57	2	66	20				1.79	−1.6	5	8.1	w.	30		28				4.0	.0	.0
West Gulf States							73.1	−0.9										72	3.36	−0.7									5.0		
Shreveport [2]	181	92	227	29.77	29.96	+.01	71.9	−1.7	89	5	82	54	24	62	30	63	59	72	4.46	+.2	7	10.4	s.	34	nw.	23	18	7	6	3.6	.0	.0
Bentonville	1,303	12	51																												
Fort Smith	463	57	82	29.49	29.96	+.03	68.5	−1.1	90	6	79	47	2	58	30	58	51	60	2.70	−2.1	9	7.7	e.	26	sw.	5	16	7	8	4.4	.0	.0
Little Rock [2]	265	94	102	29.68	29.96	+.01	67.5	−2.8	88	5	77	48	1	58	30	59	55	71	3.10	−1.7	8	8.2	nw.	27	nw.	24	15	8	8	4.5	.0	.0
Austin [2]	605	68	90	29.28	29.93		74.5	−.1	94	18	85	53	2	64	38	64	60	68	2.12	−2.5	7	7.9	s.	31	sw.	17	9	16	6	5.0	.0	.0
Brownsville [2]	20	88	96	29.90	29.92		77.6	−1.0	90	31	85	62	25	70	26	70	67	79	2.40	+.1	8	11.6	se.	27	nw.	9	9	12	10	5.6	.0	.0
Corpus Christi [2]	44	11	78	29.88	29.93	+.03	76.0	−.2	87	3	82	60	25	70	23	69	67	82	4.17	+1.0	6	12.5	se.	43	w.	23	11	12	8	5.1	.0	.0
Dallas [2]	488	230	227	29.42	29.93		71.0		90	3	80	55	24	62	26	63	58	69	6.26	+1.8	9	12.2	s.	33	w.	18	10	12	9	5.3	.0	.0
Fort Worth [1]	706	35	56	29.20	29.94	+.03	71.6	−.7	92	3	82	52	2	61	33	62	57	67	7.15	+2.5	7	11.9	s.	35	w.	18	8	10	13	6.1	.0	.0
Galveston [2]	9	106	114	29.95	29.96	+.02	73.8	−1.0	82	30	78	62	24	69	14	68	65	79	.83	−2.6	7	11.1	s.	28	nw.	18	12	12	7	4.6	.0	.0
Houston [2]	62	157	190	29.89	29.96		75.0	−.5	91	3	84	58	24	66	29	65	62	77	2.22	−2.3	6	10.5	se.	37	sc.	18	10	8	13	5.3	.0	.0
Palestine	510	64	72	29.43	29.96	+.03	71.6	−1.1	88	16	81	54	24	62	26	62	57	67	3.21	−1.3	8	7.5	s.	20	s.	18	9	11	11	5.5	.0	.0
Port Arthur	34	59	134	29.93	29.97		74.2		86	31	82	58	2	67	23				.88	−3.2	7	12.3	s.	34	se.	1	9	14	8	4.9	.0	.0
San Antonio [2]	582	111	301	29.32	29.92	+.02	75.6	+.5	94	4	86	56	2	65	34	67	62	68	4.19	+1.0	8	12.0	se.	56	w.	28	7	13	11	5.6	.0	.0
Ohio Valley and Tennessee							62.1	−2.8										68	3.94	+0.2									6.2		
Chattanooga [2]	688	71	214	29.22	29.94	−0.05	67.4	−1.4	94	7	79	42	4	56	39	57	52	67	3.10	−.7	9	8.4	w.	26	w.	1	13	12	6	4.5	.0	.0
Knoxville [2]	980	66	84	28.90	29.93	−.06	65.4	−1.8	93	8	77	40	5	54	39	56	53	63	5.13	+1.4	10	5.7	w.	25	w.	3	14	11	6	4.1	.0	.0
Memphis [2]	284	78	86	29.65	29.94	−.02	68.0	−2.6	87	17	77	44	4	59	28	58	53	65	1.74	−2.4	8	7.8	sw.	24	sw.	19	13	9	9	4.8	.0	.0
Nashville [2]	605	168	188	29.30	29.94	−.04	64.8	−3.4	91	6	75	38	4	54	32	56	50	66	3.32	−.6	7	8.6	w.	34	sw.	18	15	9	7	4.5	.0	.0
Lexington	989	6																													
Louisville [2]	545	106	129	29.34	29.92	−.06	62.6	−4.0	89	7	72	36	4	54	30	54	48	68	2.49	−1.2	15	9.5	sw.	34	sw.	19	11	12	8	5.5	T	.0
Evansville	431	76	116	29.46	29.93	−.04	63.3	−3.4	88	7	72	39	2	54	29	55	49	64	2.49	−1.4	12	9.5	sw.	34	sw.	14	7	13	11	6.2	.0	.0
Indianapolis [2]	808	98	129	29.04	29.90	−.07	59.6	−3.3	86	7	68	33	4	51	29	52	49	76	4.30	+.4	15	8.5	w.	28	nw.	1	3	7	21	7.5	T	.0
Terre Haute	575	63	149	29.29	29.90		60.3		88	7	70	35	4	51	30	52	47	67	3.62	−.2	15	9.7	sw.	30	nw.	1	1	14	16	7.4	T	.0
Cincinnati [2]	497	11	51	29.38	29.91	−.08	60.4	−2.7	89	8	70	34	4	51	32	53	48	69	3.97	+.3	15	8.0	sw.	24	w.	6	4	12	15	7.0	T	.0
Columbus	833	90	110	29.02	29.90	−.08	59.2	−3.1	88	22	69	35	3	49	36	51	46	70	4.65	+1.1	14	10.4	s.	43	s.	19	3	14	14	7.0	T	.0
Dayton	900	186	213	28.95	29.90		58.7	−3.9	84	8	68	34	2	50	34	52	47	70	6.44	+2.8	17	10.6	sw.	37	s.	19	4	14	13	6.8	T	.0
Elkins [2]	2,006	61	78	27.84	29.94	−.06	57.5	−1.7	88	19	70	29	12	45	47	50	46	74	5.97	+1.9	18	6.0	w.	28	w.	6	4	10	17	7.4	T	.0
Parkersburg	637	77	84	29.23	29.91	−.08	61.4	−2.4	91	8	73	36	5	50	39	52	46	65	3.77	+.4	13	6.1	sw.	22	sw.	6	7	11	13	6.3	.0	.0
Pittsburgh [1]	1,273	39	54	28.57	29.91	−.08	59.4	−3.0	89	19	70	36	3	49	36	51	45	66	4.14	+.9	17	10.0	sw.	42	nw.	19	1	15	15	7.7	T	.0
Lower Lake Region							56.4	−1.0										73	3.62	+0.4									7.1		
Buffalo [1]	706	243	280	29.15	29.92	−.05	53.0	−1.6	82	15	62	34	4	44	39	49	46	78	3.51	+.4	19	11.8	sw.	52	w.	19	5	7	19	7.2	.0	.0
Canton	448	10	61	29.43	29.90		56.8	+.6	83	22	68	27	12	46	36	51	46	69	2.50	−.5	15	7.4	w.	29	sw.	15	5	6	20	7.4	T	.0
Ithaca	836	77	100	29.01	29.91		58.0	+.5	87	15	68	33	12	48	36				5.35	+2.0	17	8.4	se.	30	s.	15	4	9	18	7.1	.0	.0
Oswego	335	71	85	29.55	29.92	−.05	54.6	−.6	81	15	63	35	12	46	29	50	45	74	3.05	.0	15	8.1	se.	22	e.	15	9	6	16	6.4	.0	.0
Rochester [2]	555	86	102	29.32	29.92	−.05	57.8	+.7	86	15	66	38	12	49	31	51	47	75	2.75	−.2	17	7.4	nw.	37	w.	15	4	6	21	7.7	.0	.0
Syracuse [2]	408	65	79	29.48	29.92	−.06	58.4	+.7	87	15	67	34	12	50	36	52	47	73	4.08	+1.1	17	7.1	e.	21	nw.	7	4	9	18	7.2	.0	.0
Erie	714	57	81	29.13	29.90	−.08	56.0	−.8	88	19	64	36	3	48	39	50	47	75	4.72	+1.3	17	6.9	sw.	33	s.	19	7	9	15	6.7	T	.0
Cleveland [2]	805	267	318	29.04	29.90	−.08	56.0	−1.9	85	14	64	36	4	48	33	50	44	70	3.60	+.5	17	12.8	sw.	61	sw.	19	4	13	14	7.0	.0	.0
Sandusky	629	5	67	29.21	29.89	−.09	57.2	−2.0	88	14	66	35	3	48	30				3.43	+.3	17	8.9	sw.	28	sw.	19	5	10	16	7.0	T	.0
Toledo [2]	628	79	87	29.21	29.89	−.08	57.0	−2.4	86	14	65	33	2	49	27	51	47	75	3.73	+.2	15	10.2	w.	30	w.	15	6	14	11	6.1	T	.0
Fort Wayne [2]	828	69	84	29.00	29.89		56.8	−2.5	84	13	66	32	2	48	28	50	46	73	3.18	−.7	16	9.7	sw.	28	se.	1	2	13	16	7.5	.5	.0
Detroit [1]	620	5	78	29.22	29.90	−.07	55.7	−2.3	86	14	65	33	2	46	33	50	45	71	3.56	+.4	16	9.8	sw.	35	sw.	19	2	12	17	7.4	T	.0

See footnotes at end of table.

TABLE 2.—*Climatological data for Weather Bureau stations, May 1940*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum Velocity: Miles per hour	Wind: Maximum Velocity: Direction	Wind: Maximum Velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	° *F.*	° *F.*	°*F.*		°*F.*	°*F*		°*F.*	° *F.*	° *F.*	° *F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
Upper Lake Region							**51.0**	**−1.6**										**75**	**3.78**	**+0.5**										**7.3**		
Alpena	609	13	89	29.23	29.90	−0.07	50.0	−0.5	74	6	58	32	4	42	28	45	42	78	2.46	−0.6	14	10.6	nw.	36	se.	5	4	7	20	7.5	T	0.0
Escanaba	612	51	72	29.25	29.92	−.07	48.4	−1.2	71	31	56	29	4	41	26	44	40	77	3.61	+.7	16	11.7	n.	34	n.	1	6	10	15	7.0	0.4	.0
Grand Rapids [2]	689	70	244	29.12	29.86	−.11	55.8	−2.2	86	13	65	31	2	47	30	49	45	76	4.06	+.6	21	10.7	sw.	45	sw.	12	3	11	17	7.3	.8	.0
Lansing	878	5	90	28.94	29.88	.....	54.8	−2.1	85	14	64	32	2	45	32	50	46	77	4.66	+1.2	20	8.4	sw.	32	s.	1	3	12	16	6.9	T	.0
Marquette	734	44	69	29.12	29.92	−.05	45.4	−3.6	72	12	52	29	1	39	30	41	37	77	4.37	+1.4	14	8.1	nw.	23	nw.	1	6	9	16	7.0	2.4	.0
Sault Sainte Marie [2]	724	11	52	29.11	29.90	−.05	49.0	.0	76	29	58	30	4	41	31	43	39	75	2.76	−.3	14	8.1	nw.	30	nw.	6	3	8	20	7.6	T	.0
Chicago	673	7	131	29.17	29.90	−.06	54.1	−3.4	85	14	61	31	2	47	28	48	44	76	5.16	+1.6	17	10.5	n.	30	w.	14	3	9	19	7.7	2.2	.0
Green Bay	617	109	141	29.21	29.88	−.07	52.7	−2.2	81	12	61	29	1	44	30	47	42	70	3.38	+.1	12	11.5	n.	27	n.	1	1	11	19	7.8	3.5	.0
Milwaukee [2]	698	97	221	29.14	29.90	−.06	52.2	−1.9	82	14	60	30	1	44	35	46	43	79	3.80	+.4	14	12.4	n.	36	sw.	14	2	10	19	7.7	T	.0
Duluth	1,133	5	47	28.72	29.95	−.01	47.9	+.6	84	12	57	24	1	39	37	42	36	68	3.52	+.3	14	11.4	ne.	39	ne.	14	7	9	15	6.4	.7	.0
North Dakota							**55.2**	**+1.1**										**62**	**1.73**	**−0.6**										**5.0**		
Moorhead, Minn. [2]	899	50	58	28.83	29.96	+.02	55.0	−.1	86	31	67	30	2	43	43	47	40	62	1.40	−1.5	9	8.7	n.	27	w.	5	14	8	9	5.0	.0	.0
Bismarck [1]	1,660	4	41	28.22	29.99	+.07	55.6	+1.1	91	11	70	26	1	41	47	48	40	62	1.04	−1.3	7	10.6	nw.	38	w.	5	7	19	5	5.4	.0	.0
Devils Lake	1,478	11	44	28.41	29.98	+.04	53.0	+.4	86	11	65	27	1	41	40	46	39	65	1.93	−.1	11	8.5	n.	33	n.	5	7	14	10	6.2	T	.0
Lemmon, S. Dak	1,457	11	71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Grand Forks	832	12	67	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Williston	1,878	42	50	28.00	29.97	+.04	57.1	+3.1	91	11	70	30	1	44	39	48	40	60	2.54	+.5	8	7.3	se.	25	e.	13	19	9	3	3.5	T	.0
Upper Mississippi Valley							**59.2**	**−2.4**										**66**	**2.40**	**−1.7**										**6.3**		
Minneapolis, St. Paul, Minn. [1]	838	32	61	29.02	29.92	−.02	56.0	−1.7	87	12	67	30	1	45	36	48	41	63	1.64	−2.0	14	10.6	n.	34	ne.	14	9	6	16	6.3	T	.0
Springfield, Minn	1,025	4	42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
La Crosse [2]	672	11	48	29.18	29.90	−.04	57.4	−1.9	90	12	68	33	1	47	33	49	43	68	3.06	−.7	9	5.7	n.	28	n.	2	4	9	18	7.3	T	.0
Madison [2]	866	70	78	28.97	29.90	−.06	54.6	−3.0	84	13	63	30	2	46	28	49	44	73	3.39	−.5	14	8.5	n.	24	sw.	12	2	11	18	7.6	.8	.0
Charles City	1,015	10	51	28.84	29.93	−.01	56.5	−1.3	90	13	68	31	3	45	36	49	42	65	2.66	−1.7	11	6.3	nw.	23	sw.	12	11	10	10	5.2	T	.0
Davenport [2]	606	66	161	29.26	29.91	−.04	59.3	−2.0	89	13	70	36	1	49	32	51	44	63	1.46	−2.5	9	10.3	ne.	29	nw.	2	5	14	12	6.8	T	.0
Des Moines [1]	963	5	99	28.89	29.92	−.01	59.4	−1.9	92	13	70	33	1	48	39	50	44	64	2.08	−2.5	8	10.1	n.	31	nw.	14	10	8	13	6.0	T	.0
Dubuque	699	60	79	29.15	29.90	−.05	57.8	−2.5	90	13	68	35	1	48	34	50	44	65	3.00	−1.2	12	6.5	nw.	24	nw.	2	6	6	19	7.2	T	.0
Keokuk	614	64	78	29.26	29.91	−.03	60.8	−3.0	89	13	71	35	1	51	32	52	45	62	1.28	−2.6	6	8.0	nw.	26	nw.	2	8	11	12	5.9	T	.0
Cairo	358	87	93	29.56	29.93	−.03	64.8	−3.6	88	6	74	42	4	56	29	56	49	62	1.92	−1.8	10	8.2	sw.	25	s.	14	7	12	12	5.7	.0	.0
Peoria [2]	662	11	45	29.20	29.91	−.05	58.9	−2.8	89	13	69	33	1	48	32	52	47	72	3.55	−.5	15	6.0	n.	26	w.	14	9	13	9	5.5	T	.0
Springfield, Ill. [2]	613	5	191	29.25	29.91	−.04	61.4	−1.8	90	13	72	36	1	51	34	53	49	73	3.37	−1.0	15	11.2	n.	43	w.	14	5	7	19	7.2	.2	.0
St. Louis [1]	564	179	303	29.37	29.92	−.03	64.0	−3.0	91	7	73	38	1	54	34	54	46	58	1.46	−2.9	9	11.7	nw.	31	sw.	14	10	12	9	5.1	.0	.0
Missouri Valley							**61.4**	**−0.5**										**60**	**2.29**	**−1.9**										**5.0**		
Columbia, Mo [2]	785	6	66	29.10	29.93	−.01	62.4	−1.9	91	13	74	37	1	51	33	54	48	67	3.32	−1.1	8	7.7	n.	21	nw.	1	10	14	7	4.7	T	.0
Kansas City [1]	750	38	76	29.14	29.94	+.02	63.6	−1.2	90	13	74	40	2	53	32	55	48	63	4.33	−.3	8	10.1	nw.	30	nw.	15	11	12	8	4.9	.0	.0
St. Joseph [2]	817	11	49	29.07	29.94	.....	62.8	−1.4	89	13	74	38	1	52	33	54	49	68	3.52	−1.2	6	8.3	nw.	30	w.	14	15	9	7	4.1	T	.0
Springfield, Mo. [2]	1,360	5	78	28.52	29.94	+.01	61.6	−2.9	86	5	73	36	1	50	36	54	48	65	2.16	−3.0	5	8.5	nw.	28	s.	5	14	10	7	4.7	.0	.0
Topeka	987	65	87	28.89	29.93	.....	64.4	+.1	97	5	76	38	2	53	37	54	47	57	4.01	−.5	4	9.2	nw.	28	nw.	1	9	14	8	5.4	.0	.0
Lincoln [2]	1,189	11	81	28.69	29.94	+.03	61.2	−.5	95	13	74	35	2	49	37	50	42	57	.98	−3.1	5	9.9	n.	36	nw.	14	9	13	9	5.4	.0	.0
Omaha [1]	982	31	44	28.90	29.95	+.03	61.3	−1.1	95	13	73	36	1	49	37	51	43	56	1.26	−2.5	6	11.1	n.	40	nw.	14	7	13	11	5.9	.0	.0
Valentine	2,598	46	54	27.28	29.97	+.07	57.5	+1.3	93	31	72	28	15	43	40	47	38	55	.21	−2.6	2	9.2	n.	35	nw.	13	12	12	7	4.7	.0	.0
Sioux City [2]	1,138	64	106	28.78	29.95	+.03	60.8	+.4	93	13	72	33	1	49	35	51	42	57	1.66	−2.4	6	10.2	n.	37	nw.	14	7	14	10	5.6	.0	.0
Huron [1]	1,289	26	41	28.59	29.97	+.05	58.2	+1.8	92	31	72	30	1	44	42	49	41	59	.50	−2.5	4	13.3	n.	43	n.	14	13	14	4	4.6	.0	.0
Northern Slope							**57.0**	**+4.6**										**54**	**1.09**	**−1.2**										**5.2**		
Billings [1]	3,570	18	39	26.33	29.97	.....	59.9	.....	92	31	74	36	14	46	39	47	36	48	.84	.....	5	10.2	sw.	47	nw.	4	5	16	10	5.8	.0	.0
Havre	2,507	11	67	27.35	29.96	+.06	59.3	+5.9	87	10	74	34	14	45	41	48	37	52	1.67	−.4	8	8.4	w.	38	w.	30	14	14	3	4.2	.0	.0
Helena	4,124	85	111	26.03	29.98	+.05	57.1	+5.5	88	10	72	32	7	42	45	46	37	54	1.37	−.9	9	8.6	w.	40	sw.	4	4	13	14	6.6	T	.0
Missoula [2]	3,189	80	91	.....	.....	.....	58.3	+5.5	90	10	73	32	7	44	42	47	38	62	.88	−1.1	8	6.4	nw.	36	n.	16	8	14	9	5.4	.0	.0
Kalispell	2,973	48	56	26.94	29.98	+.10	56.0	+4.6	85	10	70	32	7	42	40	46	36	54	1.08	−.4	12	6.4	w.	29	sw.	2	9	10	12	5.6	.0	.0
Miles City [2]	2,634	48	55	27.24	29.97	+.06	60.4	+3.7	94	31	73	34	1	48	38	45	41	57	1.65	−.6	9	6.9	s.	32	nw.	13	5	18	8	5.4	.0	.0
Rapid City [2]	3,218	50	58	26.68	29.99	+.09	57.9	+3.9	92	11	71	34	15	45	41	47	37	52	.42	−3.1	4	8.4	n.	33	nw.	13	20	5	6	3.5	.0	.0
Cheyenne [1]	6,144	5	39	24.00	29.95	+.10	53.9	+3.6	84	31	68	27	1	39	43	43	33	54	1.29	−1.1	8	10.2	nw.	42	nw.	13	7	11	13	6.2	T	.0
Lander	5,352	60	68	24.68	29.93	+.05	56.4	+5.2	85	31	71	31	7	42	40	44	33	50	1.23	−1.0	8	5.7	sw.	32	sw.	4	9	13	9	5.5	.0	.0
Sheridan [1]	3,790	10	47	25.96	29.98	.....	56.3	.....	92	31	73	31	1	40	47	46	37	56	.67	−2.0	8	5.5	nw.	25	se.	4	10	13	8	5.4	.0	.0
Yellowstone Park	6,241	12	46	23.94	30.06	+.15	50.6	+6.0	75	10	65	24	7	36	38	40	31	55	1.03	−.8	7	7.7	sw.	28	sw.	4	8	18	5	5.1	T	.0
North Platte [2]	2,787	11	51	27.09	29.95	+.07	60.5	+1.8	90	31	75	30	15	46	45	48	39	56	.66	−2.1	2	7.7	n.	27	nw.	14	15	13	3	3.5	.0	.0
Middle Slope							**63.7**	**+1.2**										**60**	**3.15**	**−0.2**										**5.0**		
Denver [2]	5,332	106	113	24.73	29.95	+.11	59.4	+3.2	86	31	71	34	1	48	34	46	37	54	1.55	−.7	8	7.0	s.	30	nw.	13	8	8	15	6.3	.0	.0
Pueblo [2]	4,806	79	86	25.19	29.92	+.09	61.5	+2.3	90	3	75	34	1	48	40	49	40	56	1.76	+.2	10	6.2	e.	34	nw.	13	9	14	8	5.1	.0	.0
Concordia	1,392	50	58	28.49	29.95	+.04	62.8	−.4	93	13	75	38	15	51	36	53	46	59	1.49	−2.7	4	8.0	n.	26	nw.	14	13	12	6	4.4	.0	.0
Dodge City	2,509	10	86	27.36	29.93	+.06	63.8	+.3	89	5	76	40	1	52	37	54	47	60	4.41	+1.5	9	11.3	ne.	35	ne.	30	13	8	10	4.9	.0	.0
Wichita [2]	1,392	85	93	28.48	29.93	+.03	65.6	+.5	96	5	76	42	15	55	31	57	51	67	5.82	+1.4	7	9.8	s.	25	sw.	13	17	8	6	3.8	.0	.0
Oklahoma City [2]	1,304	10	47	28.57	29.92	+.03	69.0	+1.3	94	5	80	47	1	58	33	59	52	64	3.89	−1.0	9	8.9	s.	25	s.	4	13	8	10	5.2	.0	.0
Chadron, Nebr	3,439	4	58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Southern Slope							**71.0**	**+0.4**										**56**	**2.68**	**0.0**										**4.4**		
Abilene [2]	1,750	10	56	28.11	29.89	+.02	73.2	+1.2	97	4	85	51	10	62	33	61	54	61	1.57	−2.4	9	10.7	s.	26	sw.	27	11	15	5	4.7	.0	.0
Amarillo [2]	3,604	10	49	26.31	29.90	+.06	66.8	+2.7	98	5	79	45	1	54	39	54	46	61	2.68	−.1	9	9.3	se.	32	ne.	13	15	13	3	3.8	.0	.0
Del Rio	960	63	71	28.89	29.86	+.01	75.5	−1.5	94	4	86	56	24	65	29	65	59	61	3.77	+.9	7	9.7	se.	29	nw.	28	9	13	9	5.5	.0	.0
Roswell	3,566	75	85	26.34	29.89	+.07	68.4	−1.0	96	4	83	43	2	54	45	54	42	49	2.71	+1.6	5	7.7	s.	38	n.	8	14	10	7	4.4	.0	.0
Southern Plateau							**69.3**	**+4.3**										**38**	**0.55**	**0.0**										**3.6**		
El Paso [2]	3,916	82	101	26.00	29.82	+.04	73.8	+2.3	96	31	87	51	11	60	38	52	34	33	.43	+.1	5	8.6	w.	25	n.	18	15	15	1	3.2	.0	.0
Albuquerque [1]	5,314	5	34	24.74	29.84	.....	65.5	+2.2	89	31	80	37	8	51	36	49	33	38	1.71	+1.1	4	8.9	se.	50	se.	8	11	14	6	4.6	.0	.0
Santa Fe	7,013	38	53	23.28	29.91	+.10	58.1	+2.4	82	31	71	36	1	45	35	44	32	46	1.54	+.3	10	6.1	e.	25	n.	8	5	21	5	5.0	.0	.0
Flagstaff	6,907	10	59	23.37	29.85	+.07	54.3	+3.6	80	14	72	32	4	37	42	41	29	48	.15	−1.0	3	8.6	nw.	30	nw.	22	8	19	4	4.7	.0	.0
Phoenix [2]	1,112	39	87	28.65	29.77	−.01	81.5	+6.5	104	14	97	59	1	66	40	57	35	25	.01	−.1	1	6.3	e.	26	nw.	20	21	6	4	3.2	.0	.0
Yuma	142	9	54	29.64	29.78	−.01	81.7	+5.5	105	14	99	55	6	64	42	61	45	36	.00	.1	0	4.9	sw.	17	w.	16	29	2	0	.8	.0	.0
Independence	3,957	5	26	.....	.....	.....	70.3	+7.2	92	20	86	46	5	55	38	49	28	.....	T	− 2	0	.....	sw.	22	n.	16	.....	.....	.....	.....	.....	.0	.0

See footnotes at end of table.

TABLE 2.—*Climatological data for Weather Bureau stations, May 1940*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max.+mean min.÷2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch or more	Wind: Average hourly velocity	Wind: Prevailing direction	Wind: Maximum Velocity: Miles per hour	Wind: Maximum Velocity: Direction	Wind: Maximum Velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	° *F.*	° *F.*	°*F.*		°*F.*	°*F.*		°*F.*	° *F.*	° *F.*	° *F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
Middle Plateau							**63.1**	**+7.1**										**39**	**0.01**	**−0.9**										**4.1**		
Reno [2]	4,400	61	76	25.56	29.92	+0.01	61.4	+7.2	85	23	76	34	5	46	40	46	35	51	0.03	−0.6	1	7.0	w.	25	sw.	4	20	11	0	3.0	0.0	0.0
Tonopah	6,090	12	20				63.4		84	24	76	33	5	50	31	46	30		T		0		se.							3.2	.0	.0
Winnemucca	4,344	18	56	25.38	29.91	.00	61.6	+7.7	89	24	80	35	5	44	50	45	30	39	.03	−.8	3	7.7	ne.	27	sw.	11	10	15	6	4.8	.0	.0
Modena	5,473	10	46	24.59	29.85	+.03	59.2	+5.7	84	14	77	33	19	41	45	43	26	34	T	−.8	0	10.4	sw.	34	sw.	23	8	14	9	5.5	.0	.0
Salt Lake City [2]	4,227	86	210	25.70	29.88	+.02	66.0	+8.6	88	31	79	43	5	53	37	48	35	40	.01	−1.9	1	8.5	nw.	37	nw.	4	16	11	4	3.8	.0	.0
Grand Junction	4,602	60	68	25.33	29.86	+.03	67.4	+6.3	89	31	82	42	1	53	35	49	31	32	T	−.8	0	6.3	se.	20	n.	13	14	13	4	4.1	.0	.0
Northern Plateau							**61.2**	**+4.8**										**48**	**0.46**	**−0.9**										**4.9**		
Baker [2]	3,373	36	54	26.55	30.00	+.04	56.0	+4.3	86	10	72	29	6	40	42	45	37	60	.38	−1.2	3	6.7	n.	22	sw.	4	7	15	9	5.6	.0	.0
Boise [1]	2,858	5	49	27.01	29.93	−.01	61.3		92	10	76	35	5	46	40	49	38	46	.09		3	10.1	nw.	40	sw.	4	12	11	8	4.5	.0	.0
Pocatello [1]	4,478	5	31	25.46	29.94	+.05	59.6		87	10	76	28	7	44	43	45	31	41	.05		3	9.5	sw.	39	w.	4	12	9	10	4.8	.0	.0
Spokane [2]	1,968	101	110	27.92	29.98	+.02	60.5	+5.0	89	23	73	40	26	48	38	49	39	53	.64	−.8	9	6.6	s.	22	sw.	4	11	15	5	4.3	.0	.0
Walla Walla	991	57	65	28.91	29.98	+.02	64.7	+5.1	93	23	78	44	27	52	38	52	40	45	.53	−1.1	7	5.9	s.	24	w.	4	11	8	12	5.2	.0	.0
Yakima	1,076	58	67	28.84	29.98		63.6	+4.6	95	23	77	39	3	50	36	50	37	43	.27	−.4	2	6.9	nw.	27	nw.	19	10	12	9	4.9	.0	.0
North Pacific Coast Region							**58.9**	**+4.6**										**70**	**1.67**	**−0.6**										**6.1**		
North Head	211	5	56	29.85	30.07	+.04	54.0	+3.1	69	13	58	45	6	50	22	51	49	86	1.55	−1.4	13	17.2	n.	45	s.	4	3	13	15	6.8	.0	.0
Seattle [2]	14	90	321	30.01	30.04	+.03	60.4	+5.9	80	21	69	46	5	51	27	52	46	66	1.24	−.6	12	8.9	n.	34	sw.	1	7	15	9	5.5	.0	.0
Tacoma	194	172	201	29.84	30.04	+.02	58.8	+4.7	77	18	67	43	3	50	24				1.69	−.4	8	8.4	n.	28	w.	1	6	10	15	6.0	.0	.0
Tatoosh Island	86	9	61	29.96	30.06	+.05	53.2	+3.6	66	13	57	46	25	49	18	50	48	84	3.62	−.4	14	12.0	w.	43	s.	1	5	15	11	6.3	.0	.0
Medford [1]	1,329	29	58	28.59	29.98		62.1	+4.4	91	22	78	37	6	47	45	51	43	58	.57	−.6	6		nw.				8	11	12	5.8	.0	.0
Portland, Oreg. [2]	39	68	106	29.99	30.03	.00	62.6	+5.7	89	9	73	44	3	52	35	53	46	62	1.57	−.6	6	7.1	nw.	21	sw.	30	6	11	14	6.2	.0	.0
Roseburg	510	45	76	29.47	30.02	−.01	60.9	+4.9	88	18	74	41	3	47	41	52	45	62	1.44	−.5	0	5.1	n.	31	sw.	4	7	14	10	5.6	.0	.0
Middle Pacific Coast Region							**62.7**	**+3.1**										**67**	**0.39**	**+0.1**										**5.7**		
Eureka	60	72	88	29.99	30.06	+.01	55.2	+3.2	79	1	61	43	5	50	28	51	48	81	2.54	+.7	10	8.4	n.	30	sw.	1	5	11	15	6.9	.0	.0
Redding [1]	722	20	34	29.14	29.91		70.8	+4.4	98	19	82	42	5	60	31	56	43	42	1.12	−.4	4	8.4	nw.	24	s.	3	7	11	13	5.8	.0	.0
Sacramento [1]	25	92	115	29.89	29.92	−.02	66.8	+3.5	93	19	80	46	5	53	40	57	51	65	.92	+.2	2	7.5	s.	20	sw.	27	15	11	5	3.9	.0	.0
San Francisco	155	112	132	29.80	29.97	−.02	58.0	+1.2	76	13	64	50	26	52	24	53	50	79	.63	−.2	5	10.2	w.	29	w.	10	5	16	10	6.1	.0	.0
South Pacific Coast Region							**67.7**	**+4.3**										**64**	**0.01**	**−0.4**										**3.9**		
Fresno [1]	327	89	98	29.59	29.89	−.03	72.2	+5.1	99	20	88	47	7	56	39	58	46	46	T	−.4	0	8.3	nw.	26	nw.	2	18	9	4	3.4	.0	.0
Los Angeles	512	223	250	29.40	29.94	−.01	66.0	+3.8	94	9	75	51	7	57	32	58	54	72	.02	−.4	1	6.1	w.	21	w.	31	13	13	5	3.9	.0	.0
San Diego [2]	28	62	70	29.91	29.94	−.01	64.8	+4.0	80	9	71	54	7	59	22	59	55	74	T	−.4	0	7.0	w.	18	w.	31	13	11	7	4.5	.0	.0
West Indies																																
San Juan, P. R.	82	10	54	29.88	29.96		78.9	+.3	91	12	84	69	19	74	19				7.74	+2.5	18	10.5	e.	42	n.	19	1	15	15	6.9	.0	.0
Panama Canal																																
Balboa Heights	118	6	92		[3] 29.81	−.02	82.7	+2.0	95	1	90	73	19	76	18			[3] 80	7.26	−.7	18	6.1	nw.	20	nw.	31	0	24	7	6.7	.0	.0
Cristobal	36	6	97		[3] 29.83	−.01	83.5	+2.8	92	24	88	75	5	79	15	77	76	[3] 80	11.00	−1.6	21	9.2	n.	27	nw.	16	0	11	20	8.2	.0	.0
Alaska																																
Fairbanks	454	11	87	29.35	29.86		49.2	+2.2	80	30	62	28	16	37	37	42	32	57	1.39	+.8	9	6.4	n.	24	e.	21	6	10	15	6.7	.0	.0
Juneau	80	96	116	[4] 29.89	[4] 29.98		49.0	+1.2	76	31	56	36	1	42	29	44	38	70	6.40	+1.2	19	6.8	s.	25	e.	17	4	3	24	8.1	.0	.0
Nome	22	5	59																													
Hawaiian Islands																																
Honolulu	38	86	100	29.96	30.00		76.2	+1.4	83	8	81	70	25	72	13	69	66	73	2.54	+.8	23	8.8	e.	27	ne.	23	5	16	10	6.1	.0	.0

[1] Data are airport records.
[2] Barometric and hygrometric data from airport, other data city office records.
[3] Observations taken bihourly.
[4] Pressure not reduced to a mean of 24 hours.
[5] Barometric, hygrometric, and temperature records from airport, other data from city office records.

NOTE.—Except as indicated by notes, 1 and 2, data in table 2, are city office records.

TABLE 3.—*Data furnished by the Canadian Meteorological Service*

[With the April 1940 issue of the REVIEW, the Canadian Meteorological Service has discontinued sending reports of observations for an indefinite period.—*Editor.*]

TABLE 4.—*Severe local storms, May 1940*

[Compiled by Mary O. Souder from reports submitted by Weather Bureau officials]

The table herewith contains such data as has been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the United States Meteorological Yearbook]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Campobello, S. C.	1	3:30 p. m.	880		$2,000	Hail	Loss in peach crop.
Winburne, Pa., and vicinity	1	4 p. m.		0		Tornado	Wooden garage carried 75 feet and demolished; a 4-year old child thrown with such force against the door as to break her collarbone.
Chicago, Ill.[2]	1–2					Snow	2.2 inches of snow recorded. Since the establishment of the Chicago Weather Bureau there had never been 2 consecutive days of measurable snow in May.
Virginia, Nebr.	6	5:30 a. m.	[1] 2		2,000	Hail	Property damaged.
Hebron to Gilead, Nebr.	6	10:40–11:15 a. m.	[1] 2–4		2,000	do	Do.
Plainville, Kans., and vicinity.	6	7:30–10:30	[1] 6		10,000	Wind, hail and rain.	Damage mostly to roofs and gardens; path 6 miles long.
Coldwater, Kans., 5 miles southwest.	7	4 p. m.	50	0		Small tornado	Vortex cloud divided into upper and lower sections soon after it formed; path 5 miles long.
Forrest School, N. Mex.	7	5 p. m.	[1] 5		3,000	Heavy hail	300 sheep killed.
Wichita, Kans., north of	8				4,000	Heavy rain	Bridge across Chisholm Creek, in northern portion of the city, washed out.
El Paso, Tex.	8		[1] 10		75,000	Hail	Loss in crops; damage to roofs and automobile tops.
Albuquerque, N. Mex.	8	12:45–2:30 p. m.	[1] 3		23,000	Heavy hail	Loss to crops, $20,000; property damage, $3,000.
Presidio, Tex.	8	2:30 p. m.	[1] 5		6,000	Hail	$5,000 loss to crops; $1,000 damage to buildings.
Seminole, Tex.	8	8 p. m.	[1] 2½		1,000	do	Loss to crops, $1,000; property damage severe, but not estimated.
Santee, Nebr.	13	6 p. m.	[1] 5		2,000	do	Property damaged.
Menno, S. Dak., and vicinity	13	7 p. m.			1,000	Wind and hail	Property, trees, and gardens damaged.
LaCrosse, Wis., and vicinity	13	7–8 p. m.			1,500	Hail	Damage to automobile tops and windows.
Oceana County, Mich., northern portion.	14	1:30–1:45 a. m.			100,000	Tornadic wind, electrical, and rain.	Barns and many small buildings demolished; trees and telephone poles blown down.
Minneiska, Minn.	14	5:25 p. m.	[1] 10		1,500	Hail	Considerable damage in places to property and fruit trees. Storm moved from northwest to southeast over a path 60 miles long.
Elm Creek, Nebr., 4½ miles west.	14			2	3,000	Wind and dust	High wind with blowing dust caused the piling-up of 3 passenger automobiles and 2 trucks, killing 2 children and injuring 8 other persons.
Harristown, Ill.	14				750	Wind	Property damaged.
Illiopolis, Ill.	14				2,000	do	Do.
Jerseyville, Ill.	14				2,000	do	Do.
Kane County, Ill.	14				60,000	Wind and hail	Property damage from wind, $35,000; from hail, $10,000. Crop loss from wind, $10,000: from hail, $5,000.
McHenry County, Ill.	14				190,000	do	Property 7damage from wind, $115,000; from hail, $35,000. Crop loss from wind, $30,000; from hail, $10,000.
Medora, Ill.	14				1,000	Wind	Property damaged; 1 person injured.
Springfield, Ill.	14				600	do	Do.
Taylorville, Ill.	14				500	Electrical	House damaged.
Bird Island, Minn.	14				2,000	Thundersquall	Property damaged.
Amherst, N. Y.	15				5,000	Electrical	Barn and contents burned.
New York, northern portion.	15			2		Thundersqualls	Property damaged; 2 men killed by lightning.
Hartsville, S. C., vicinity of.	16	12 Noon			2,000	Electrical	Residence burned.
Mesquite to Anthony, N. Mex.	16		[1] 3		75,000	Heavy hail	Loss to crops.
Mexia, Tex.	18	2 p. m.	[1] 1		10,000	Hail	Loss to crops, $10,000; property damage negligible.
Troy, Tex.	18	3:45 p. m.	[1] 3		10,500	Wind and hail	Damage to buildings, $500; loss to crops, $10,000, mostly from hail.
Bee Branch, Ark., 4 miles northwest.	18	6 p. m.	440	0	5,000	Tornado	Several buildings destroyed; forest observation tower blown over.
Engle, Tex.	18	6:45 p. m.	440	0		Tornado and hail	A wooden structure 2 stories high, 2 barns, and several shade trees blown down; some damage from hail.
Dexter to Hagerman, N. Mex.	18				1,000	Heavy hail	Loss to crops.
Centerville, Tex.	18		[1] 2		20,000	Hail	Property damaged; livestock killed; loss in crops.
El Paso, Tex.	19	4–4:10 p. m.			10,000	do	Loss in cotton, small grains, and truck.
Erie and Niagara Counties, N. Y.	19				25,000	Thundersqualls	Several barns and small buildings blown down; telephone and power lines damaged by falling trees.
Penn Line, Pa.	19					Wind	Damage to trees, 3 silos blown down; barn unroofed.
Sprout Springs, Va., 2 miles south.	20	4–4:30 p. m.	440			Hail	Severe damage to wheat, tobacco beds, and gardens; property damaged.
Guide Rock, Boswick, and Superior, Nebr.	20	4–7 p. m.	[1] 1–5		5,000	do	Heavy fall of small hailstones over a path 15 miles long.
Burr Oak, Kans., and vicinity.	20	7 p. m.	[1] 4		35,000	Heavy hail	Loss chiefly in wheat; path 7 miles long.
Erie, Pa., and vicinity	20					Wind	Windows shattered; 1 person injured.
Pittsylvania, southern Bedford, Patrick and southern Campbell Counties, Va.	20				26,500	Thundersquall and hail.	$15,000 damage to crops, mostly wheat, tobacco beds, and farm gardens. Damage to property in Campbell County from hail, $10,000, and from wind, $1,500.
Paris, Tex., vicinity of	21	5 a. m.	[1] 3		14,000	Hail	Loss in crops.
Chickasha and Verden, Okla.	21	P. m.		1		Tornadic wind, rain, and hail.	Many farm buildings wrecked; several persons injured.
Pauline, S. C., and vicinity	21	3 p. m.	880	0	3,000	Incipient tornado	Roofs and other property damaged; outbuildings, power and telephone lines, and trees blown down.
Pauline, Gramling, and Walnut Groves, S. C., and vicinities.	21	do			5,000	Hail	Loss to fruit and crops.
Roland, Ark.	22	1 p. m.			25,000	Electrical	Brick schoolhouse destroyed by fire.
Oconee County, S.C.	22	3 p. m.	[1] 2		10,000	Hail	Loss to growing crops and fruit. Size of hailstones ¼ to ½ inch in diameter, drifts a foot or more deep.
Calallen, Tex.	23	7 a. m.	0			Tornado	Several small homes destroyed.
Corpus Christi, Tex.	23	do	[1] 4			Wind and hail	Loss in crops, communication, and power lines; large plane damaged.
Las Vegas, N. Mex.	23	5 p. m.	[1] 3		1,000	Hail	Loss in alfalfa and wheat.
Paxville, S. C., and vicinity	23	do			700	Wind	Property damaged. Some indication of an incipient tornado.
Konawa, Vamoosa, and Boelegs, Okla., and vicinities.	24					Hail	North from Ada motor traffic was stalled for several hours in drifts of hail ranging from 1 foot to 6 feet; crops ruined and windows broken in virtually every home in the farming district.
Salisbury and Cambridge, Md., and vicinities.	27	P. m.	[1] 12			Hail	The storm struck in the Cambridge area and swept across the shore past Salisbury where large hailstones covered the ground. Path 40 to 50 miles long southeastward toward the Atlantic coast.

See footnotes at end of table.

TABLE 4.—*Severe local storms, May 1940*—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Westcliffe, Colo.	28	3:30 p. m.	67,100	0		Tornado	The funnel clouds traveled from the north to the southeast. The tornado was seen from a distance of 10 miles and occurred in a sparsely settled region. Only damage reported was to an old deserted farmhouse and barn which were torn apart and scattered over the countryside.
D'Hanis, Tex., vicinity of	28	8 p. m.	[1] 1		$20,000	Hail	Loss in crops; severe damage to 1,000 acres of corn.
Providence and Holly Hill, S. C., and vicinities.	29	A. m.			5,000	do	Loss in matured oats and growing crops.
Van Houten, N. Mex.[2]	29	P. m.				do	Storm lasted 2 hours with damage to roofs, windows, and automobiles.
Big Sandy, Mont.	30	4–10 p. m.			500	Straight-line-wind	Chief damage to power poles; minor property damage.
Garfield-Farmington, Wash.	30	8:30–11:30 p. m.	[1] 1–6		70,000	Rain and hail	Loss to crops and damage to windows and roofs from hail. Roads and railroad tracks washed by heavy rain; little soil erosion.
LATE REPORTS FOR APRIL 1940							
Larned, Kans., 10 miles northeast.	30	3 p. m.	[1] 2		$8,000	Hail	Loss in wheat; damage to roofs and windows; path 15 miles long.

[1] Miles instead of yards.
[2] From press reports.

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, May 1940

U. S. GOVERNMENT PRINTING OFFICE: 1940

Chart I. Departure (°F.) of the Mean Temperature from the Normal, and Wind Roses for Selected Stations, May 1940

Chart II. Tracks of Centers of Anticyclones, May 1940. (Inset) Departure of Monthly Mean Pressure from Normal

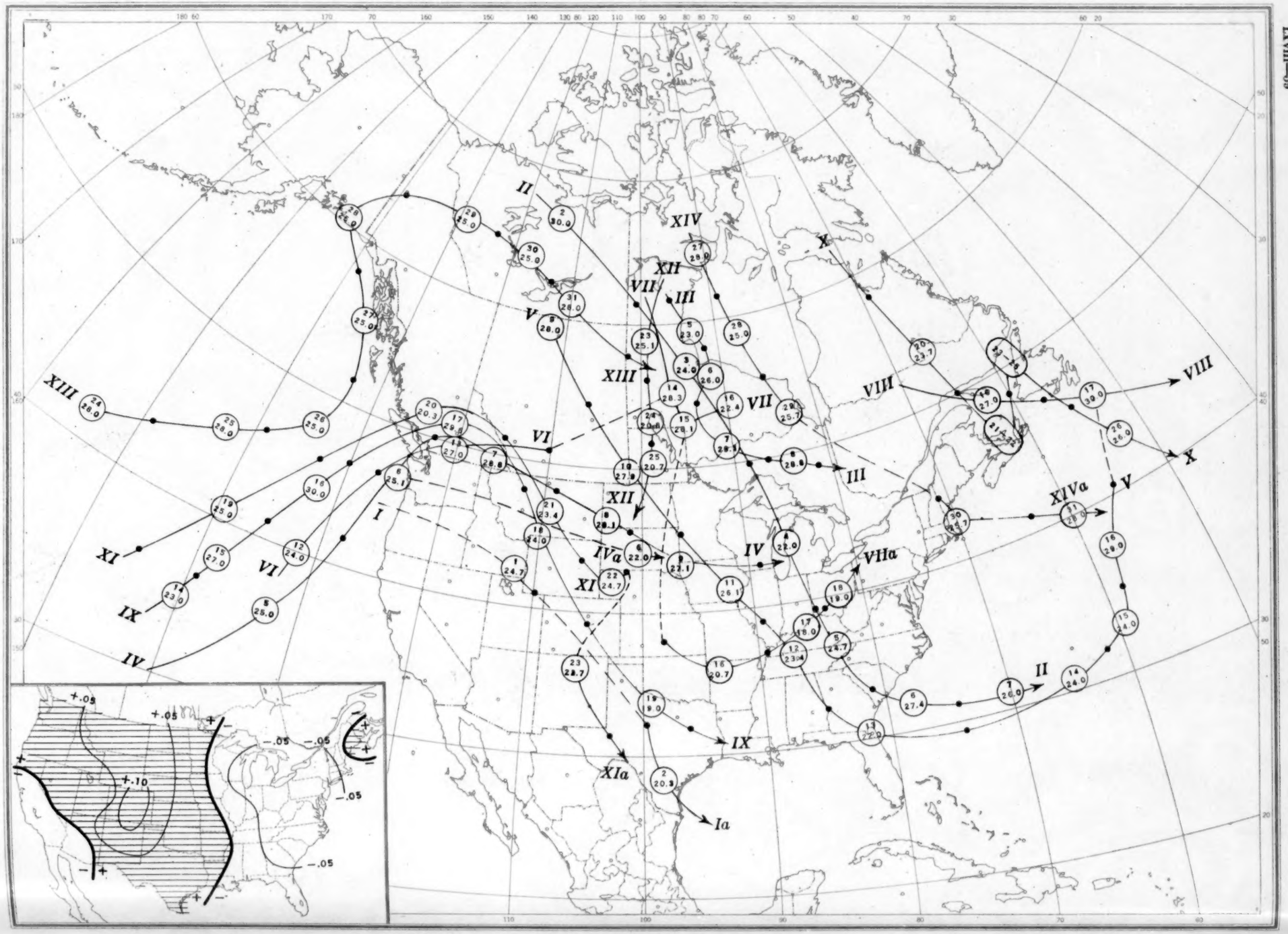
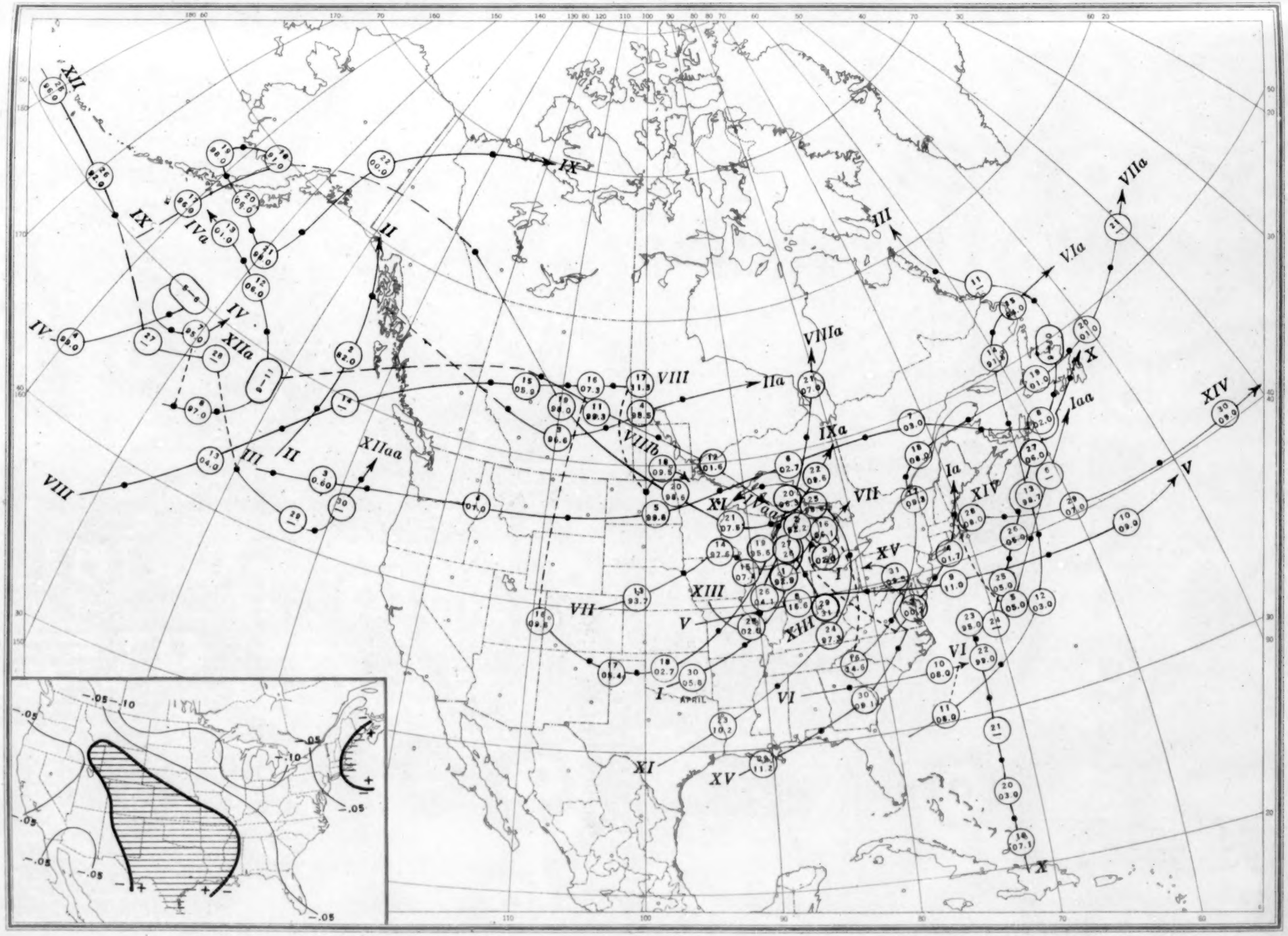


Chart III. Tracks of Centers of Cyclones, May 1940. (Inset) Change in Mean Pressure from Preceding Month

Chart III. Tracks of Centers of Cyclones, May 1940. (Inset) Change in Mean Pressure from Preceding Month



Circle indicates position of cyclone at 7:30 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 7:30 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, May 1940

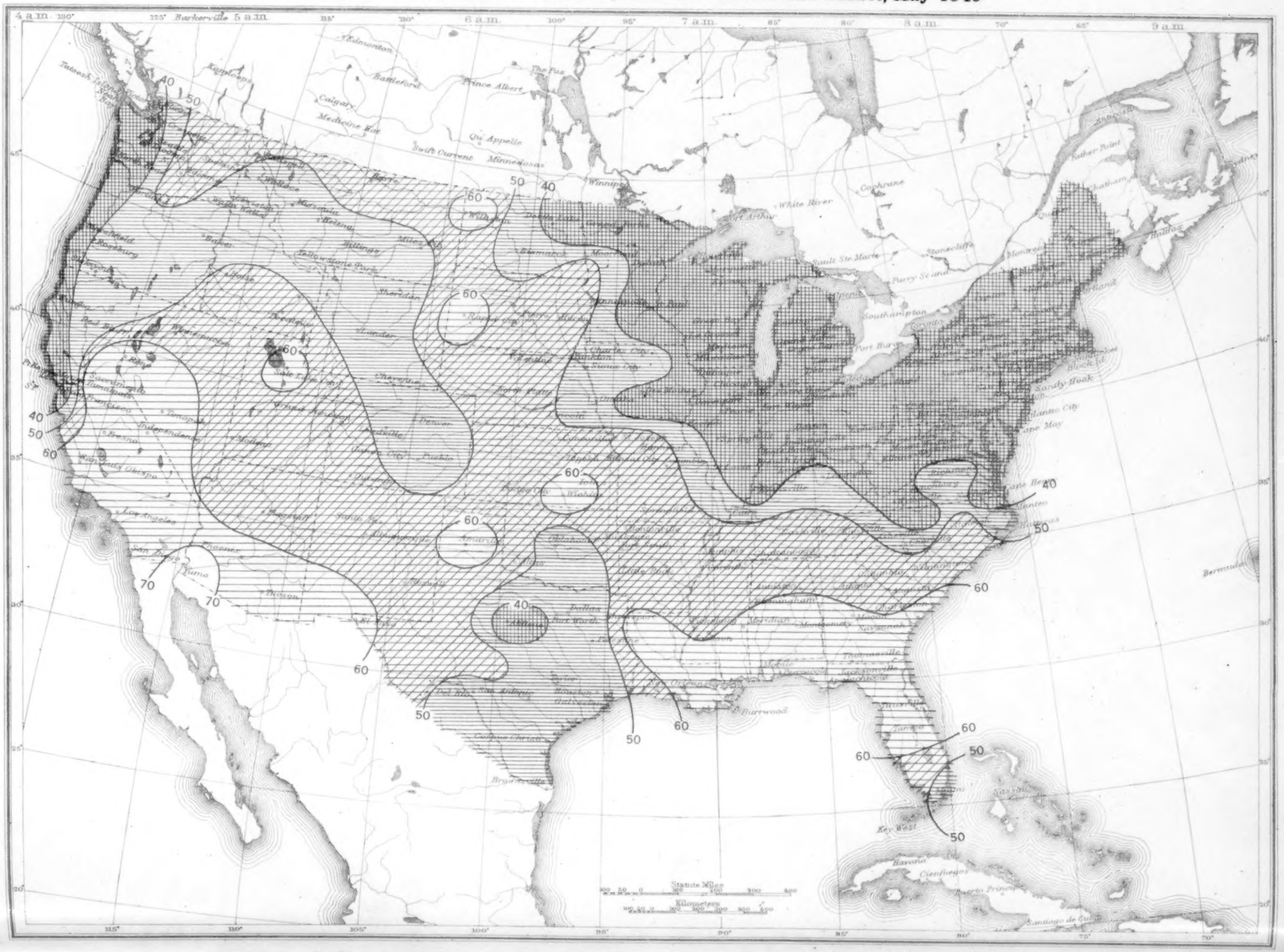


Chart V. Total Precipitation, Inches, May 1940. (Inset) Departure of Precipitation from Normal

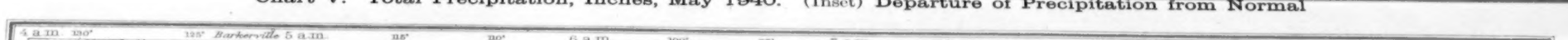


Chart V. Total Precipitation, Inches, May 1940. (Inset) Departure of Precipitation from Normal

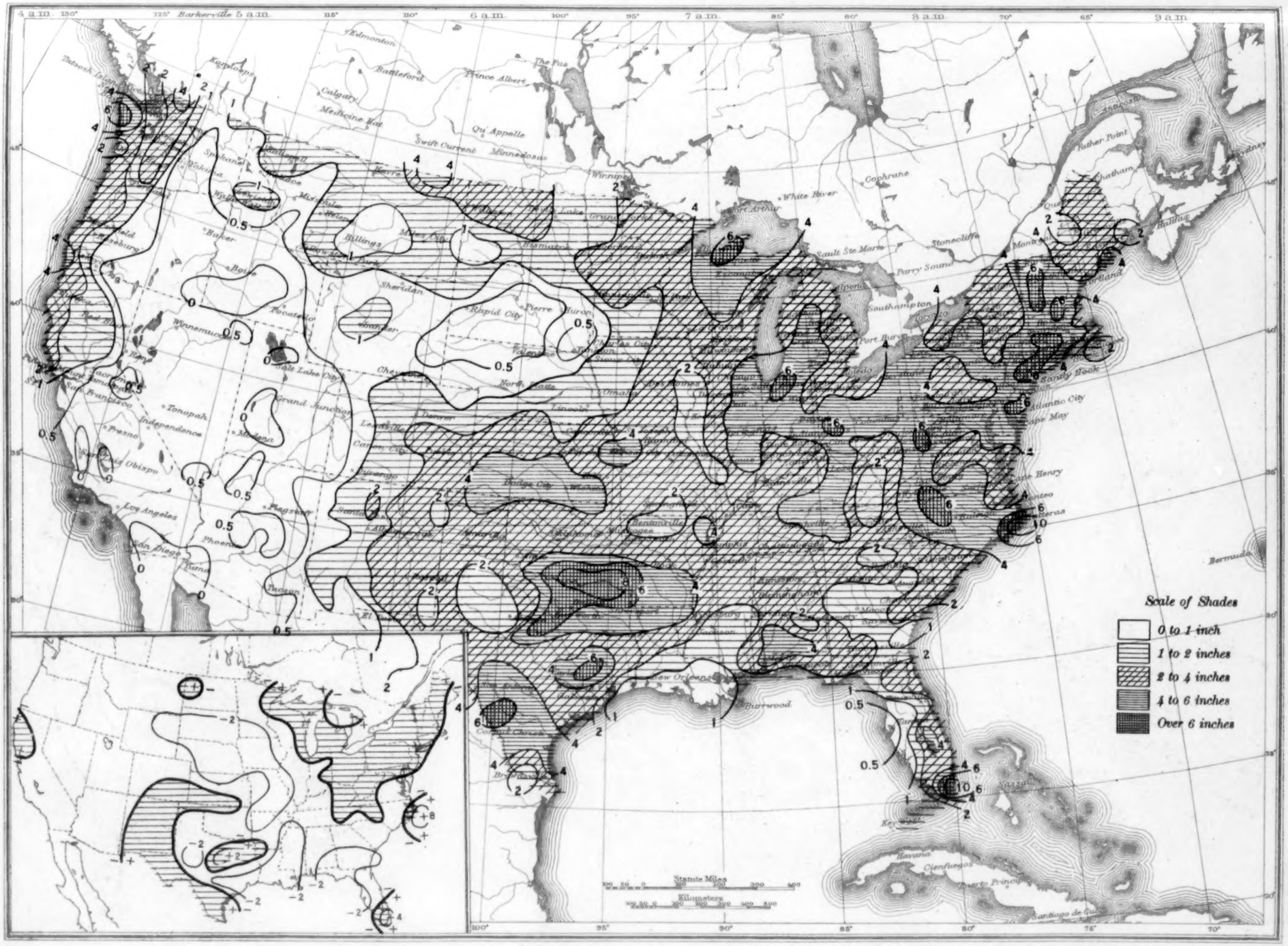


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, May 1940

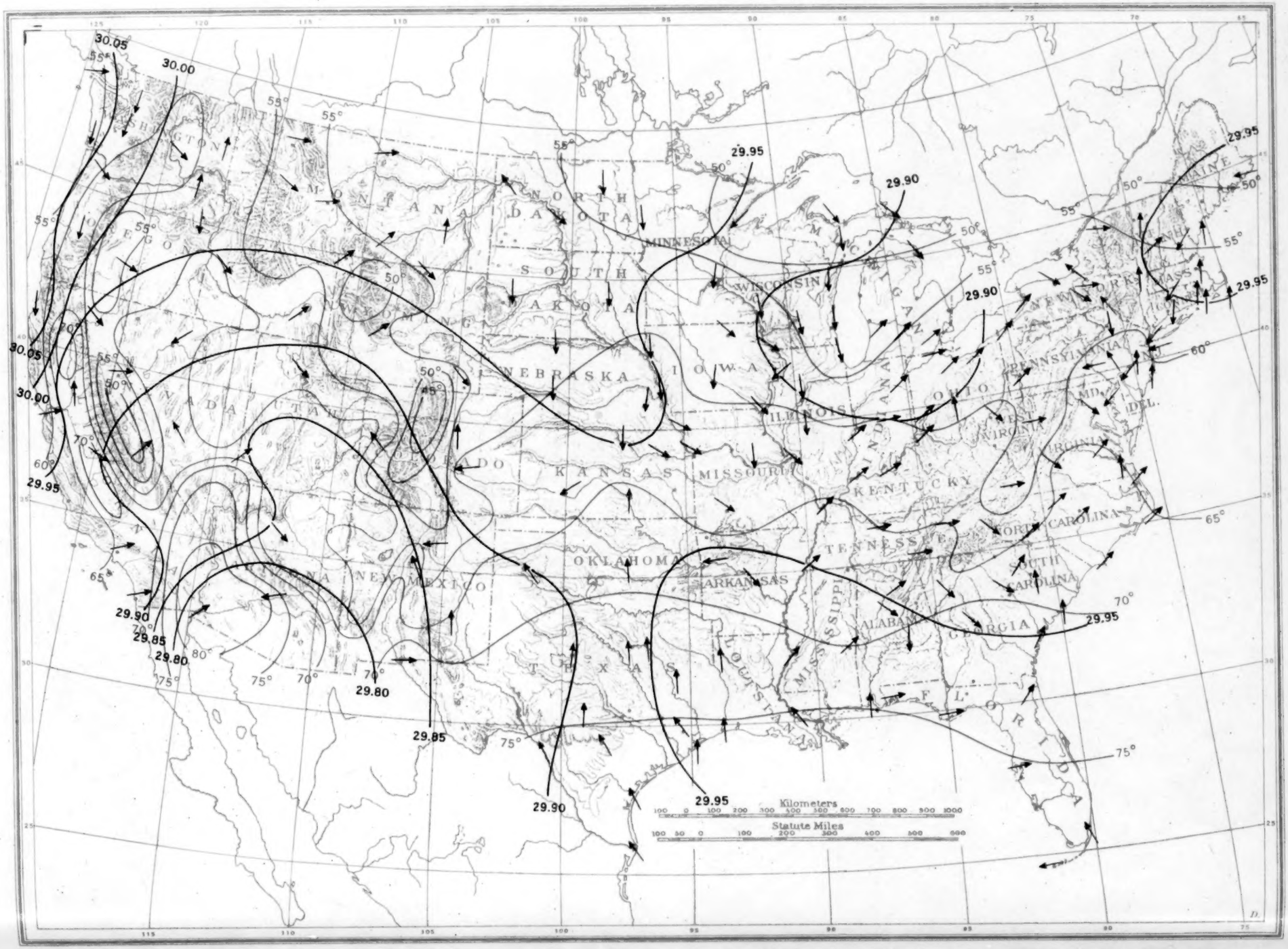


Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) May 1940

Chart VIII. Isobars (mb) for 1,524 Meters (5,000 ft.) and Isotherms (°C.) and Resultant Winds for 1,500 Meters (m. s. l.) May 1940

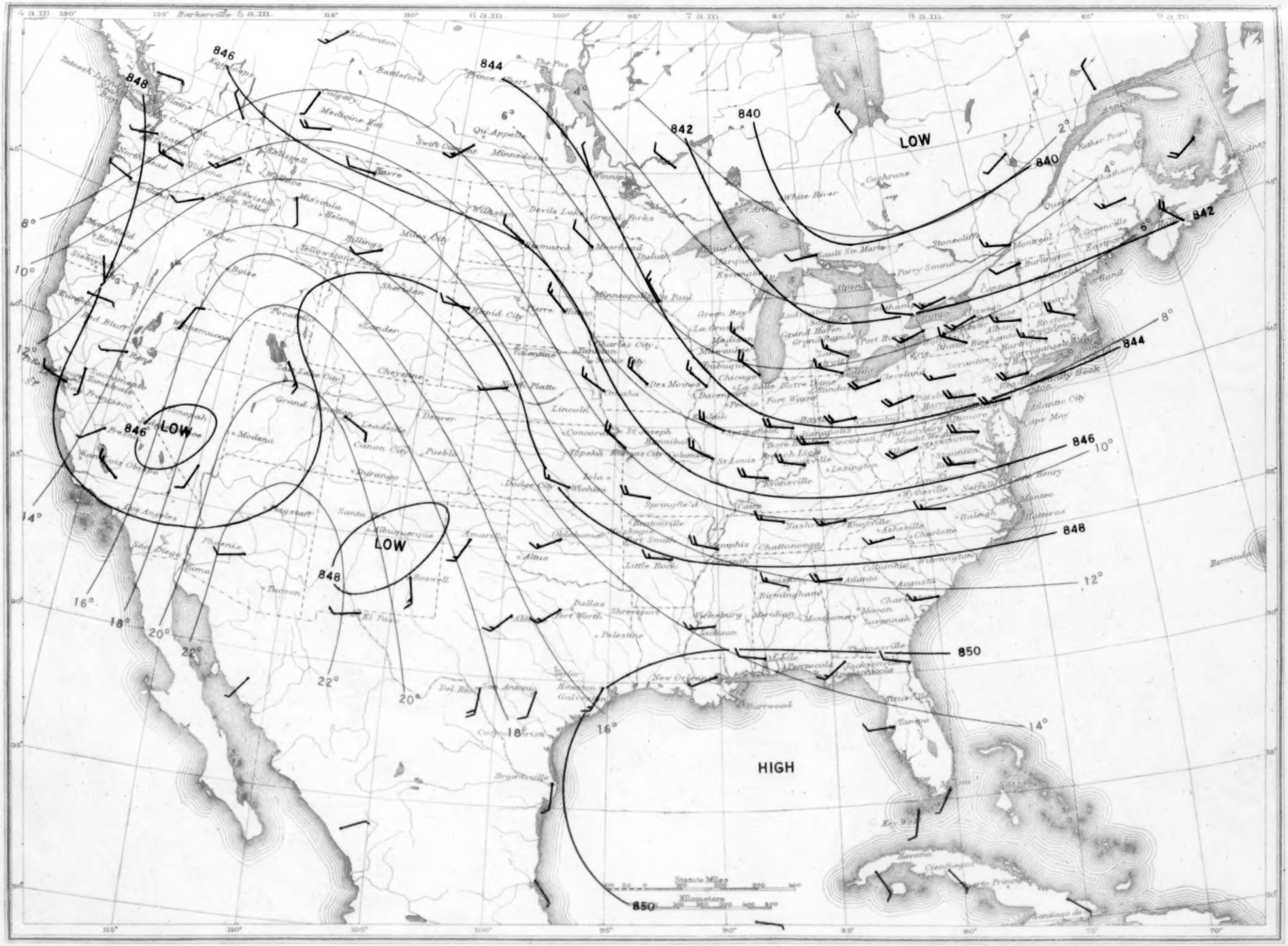


Chart IX. Isobars (mb) Isotherms (°C.) and Resultant Winds for 3,000 Meters (m. s. l.) May 1940

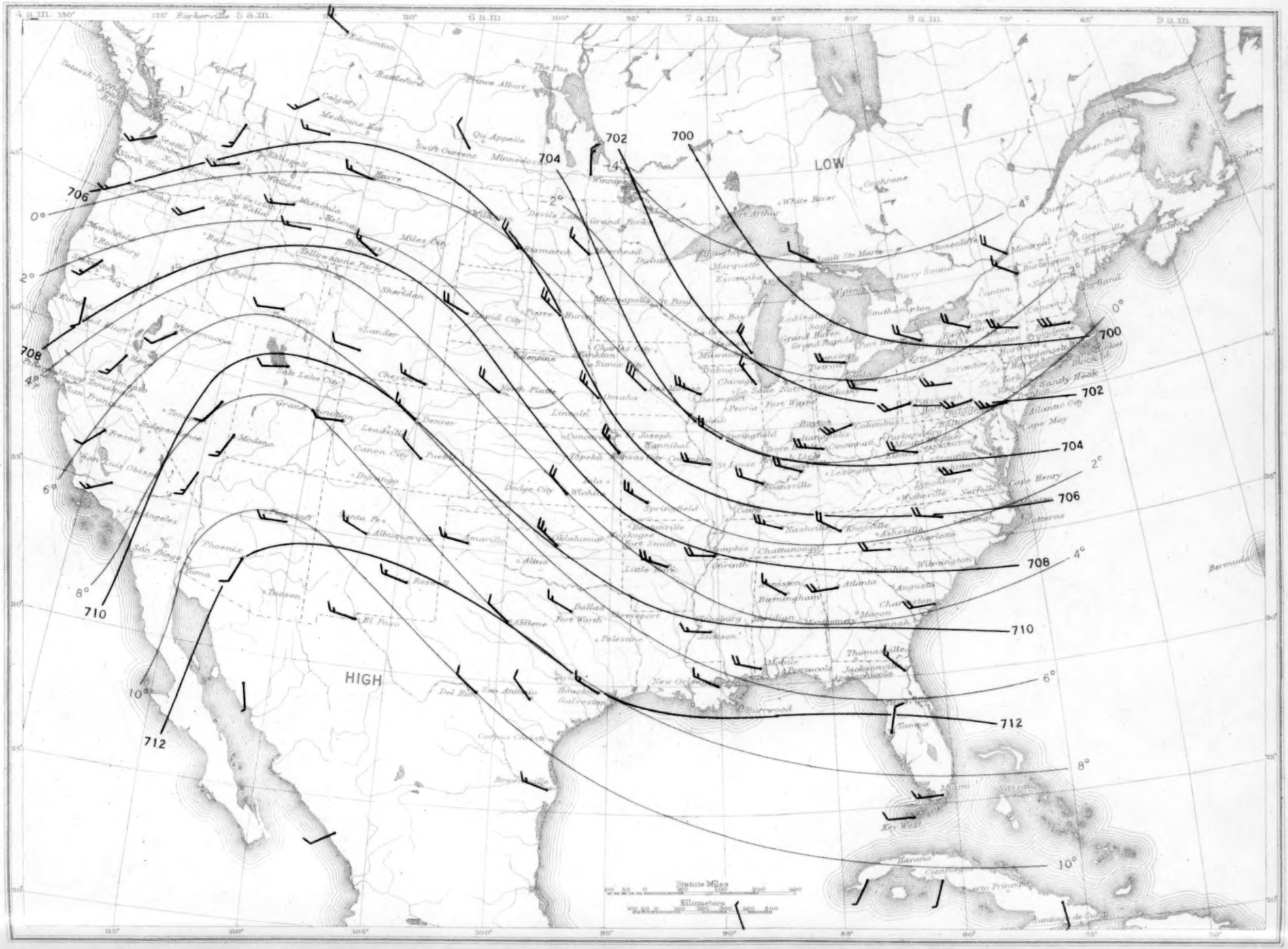


Chart X. Isobars (mb) Isotherms (°C.) and Resultant Winds for 5,000 Meters (m. s. l.) May 1940

Chart X. Isobars (mb) Isotherms (°C.) and Resultant Winds for 5,000 Meters (m. s. l.) May 1940

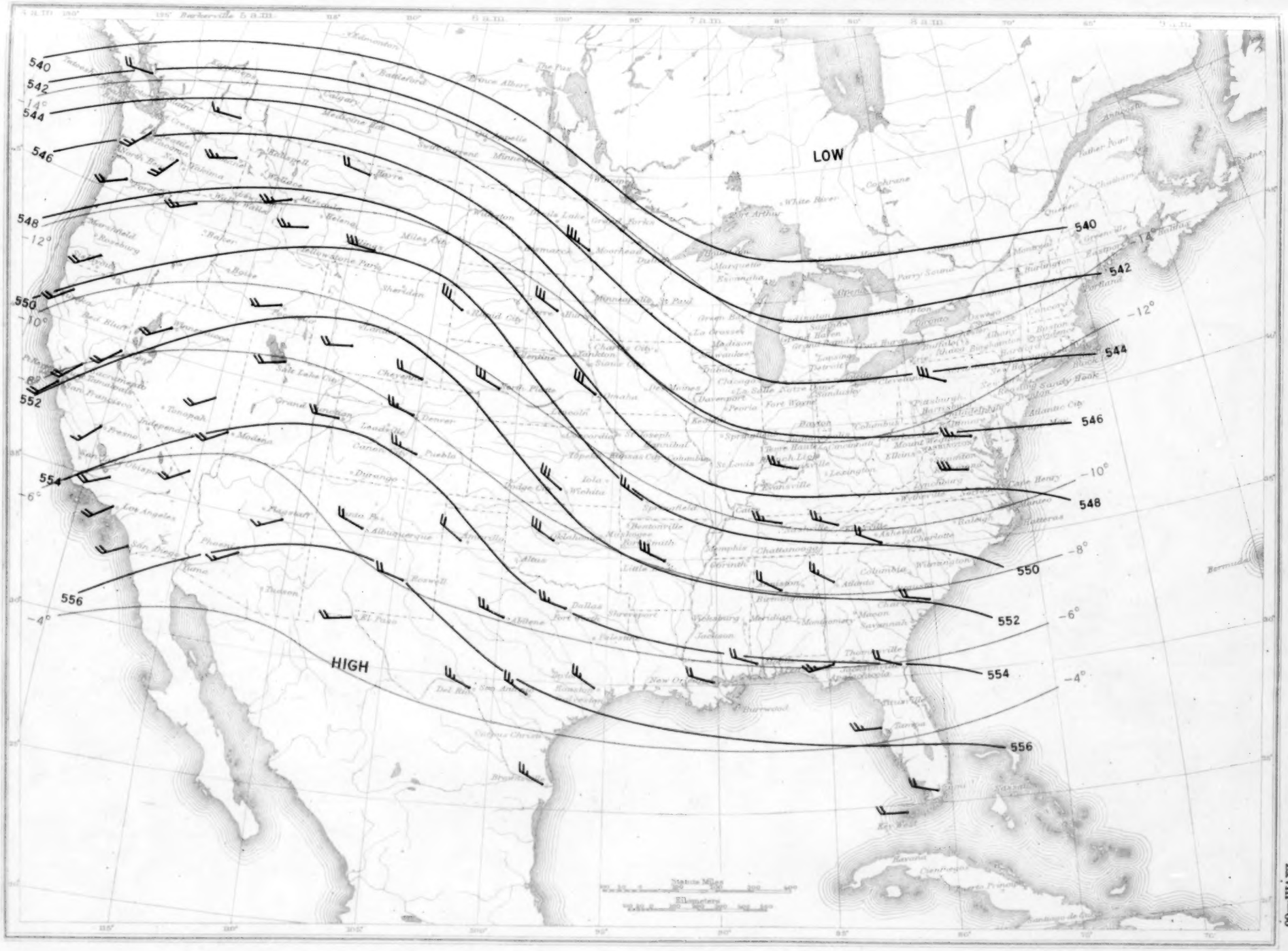


Chart XI. Isobars (mb) Isotherms (°C.) and Resultant Winds for 10,000 Meters (m. s. l.) May 1940

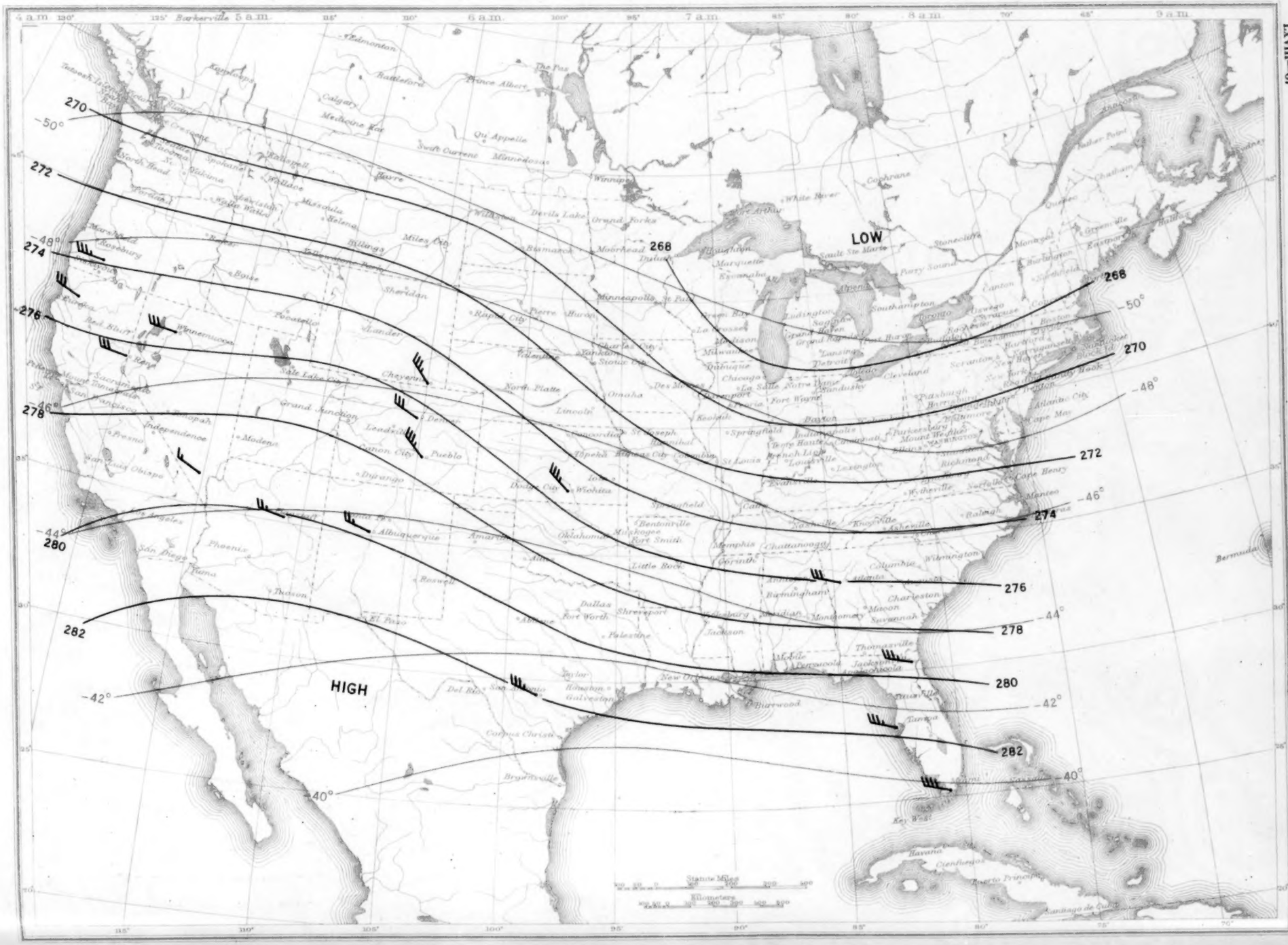


Chart XII. Mean Isentropic Chart, May 1940 (Potential Temperature 310° A.)

Chart XII. Mean Isentropic Chart, May 1940 (Potential Temperature 310° A.)

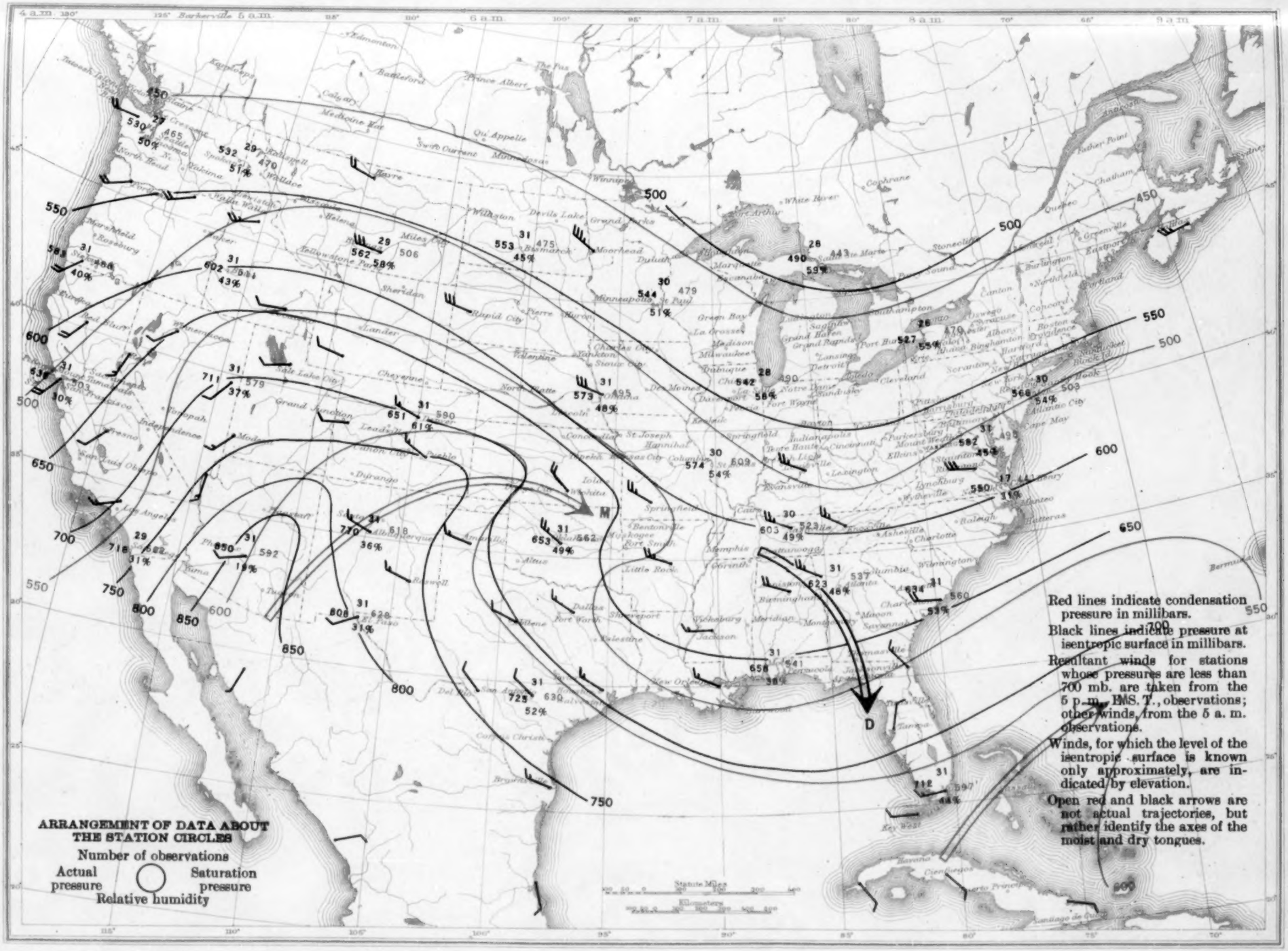
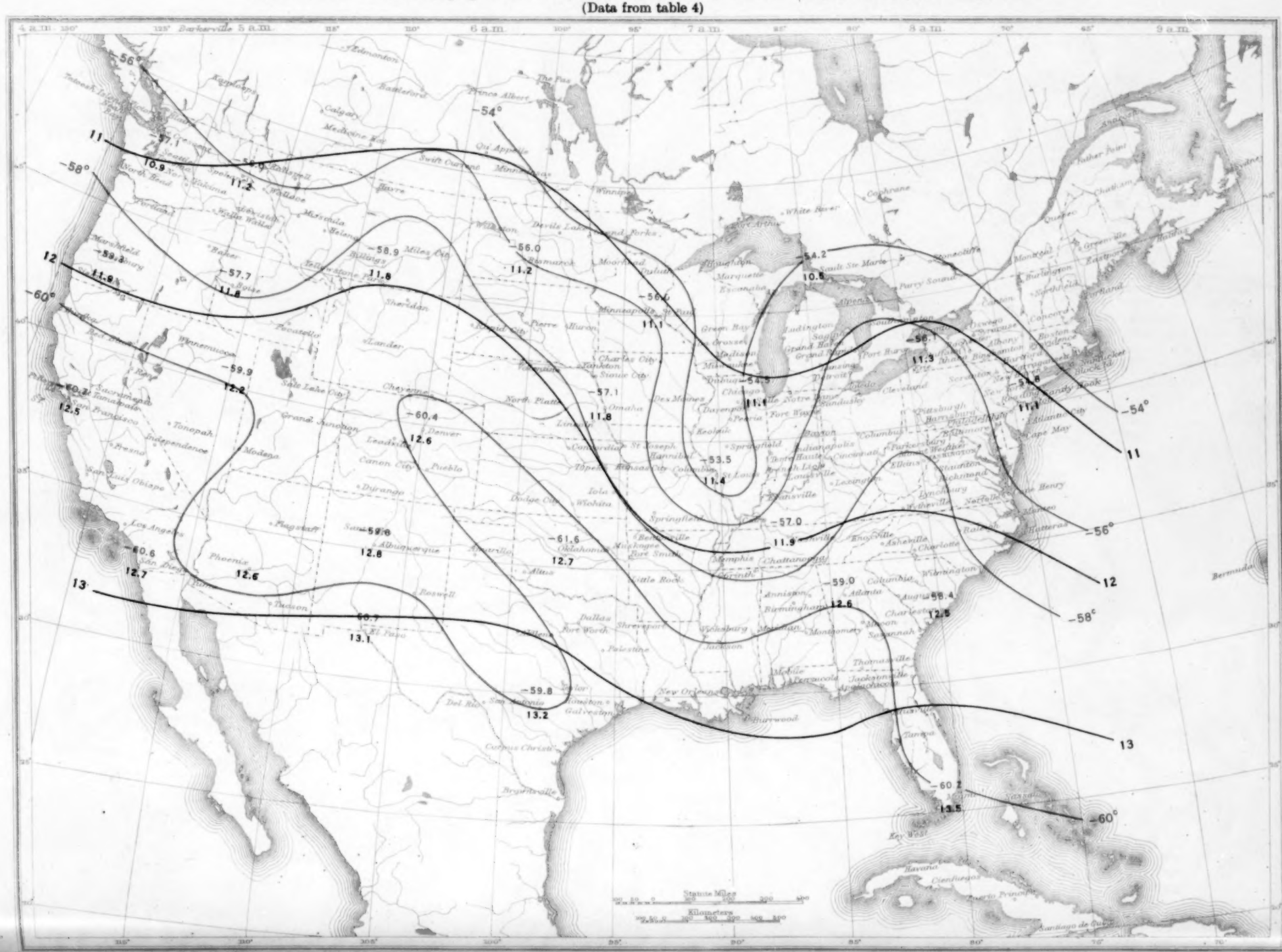

ARRANGEMENT OF DATA ABOUT THE STATION CIRCLES
Number of observations
Actual pressure
Saturation pressure
Relative humidity
Red lines indicate condensation pressure in millibars.
Black lines indicate pressure at isentropic surface in millibars.
Resultant winds for stations whose pressures are less than 700 mb. are taken from the 5 p. m., E.S.T., observations; other winds, from the 5 a. m. observations.
Winds, for which the level of the isentropic surface is known only approximately, are indicated by elevation.
Open red and black arrows are not actual trajectories, but rather identify the axes of the moist and dry tongues.
M
D

Chart XIII. Mean Tropopause Data, Altitude (km.) (m. s. l.) Temperature (°C.) May 1940

(Data from table 4)